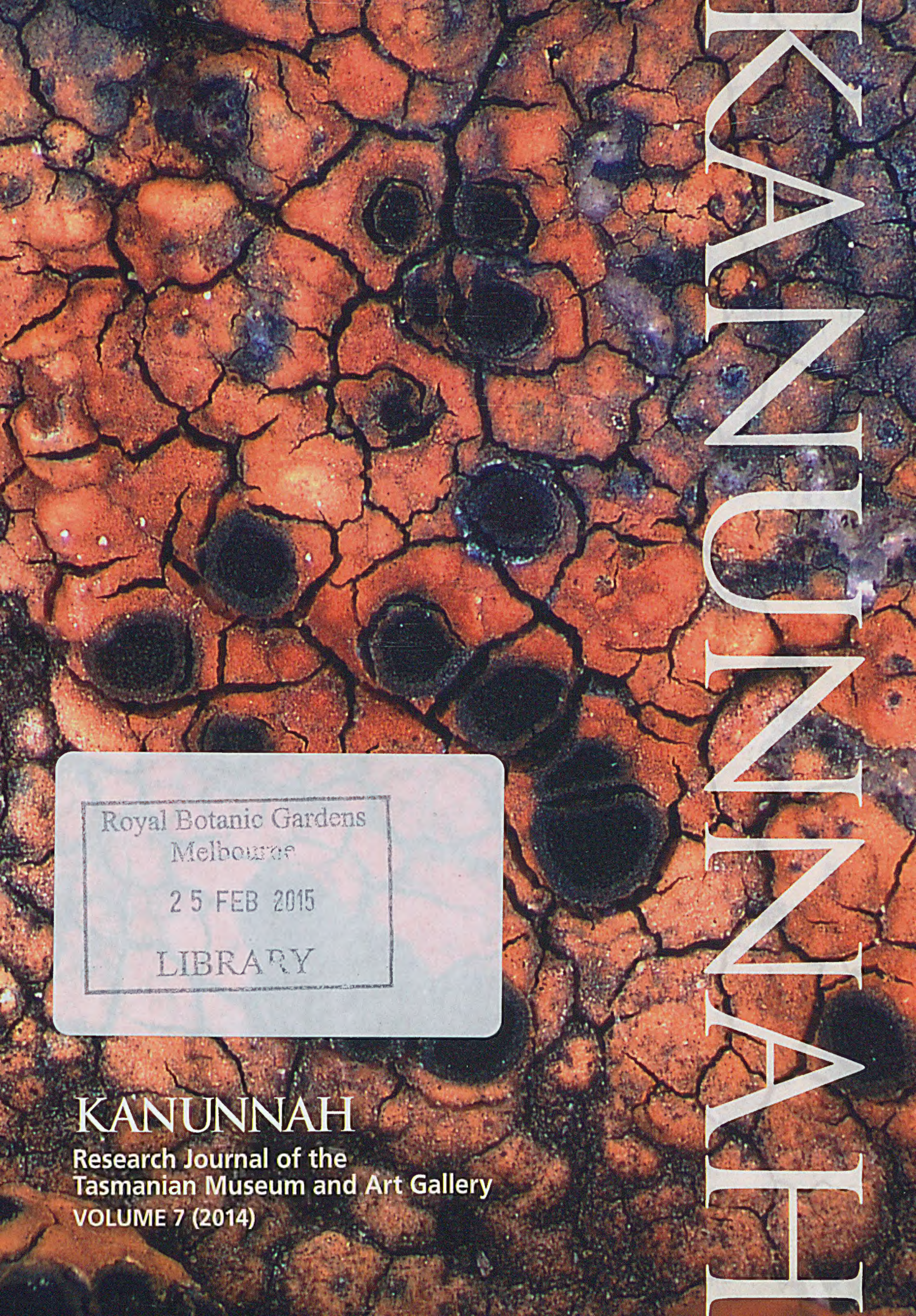

KANUNNAH

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Research Journal of the
Tasmanian Museum and Art Gallery
VOLUME 7 (2014)

KANUNNAH

The Research Journal of the
Tasmanian Museum and Art Gallery

VOLUME 7

Ka-nunnah – 'Thylacine'

The oldest fossils of thylacines are Late Oligocene to Middle Miocene in age (20–25 My B.P.) and are from the Riversleigh deposits in north-western Queensland (Vickers-Rich *et al.* 1991). It is speculated that competition with introduced dingoes in mainland Australia may have caused their extinction in mainland Australia during the last 5000 years. The most recent remains of thylacines in mainland Australia were dated at just over 3000 years old (Archer 1974).

The thylacine (*Thylacinus cynocephalus*) in Tasmania coexisted with Aboriginal people for millennia. The arrival of Europeans in Tasmania resulted, in just over a hundred years, in the extinction of thylacines from their last refuge. The demise of the thylacine resulted in the extinction of an entire lineage of marsupials from the planet.

To the Aboriginal people of Tasmania the thylacine was called many things due to its wide spread distribution in the State. Tribes from the areas of Mount Royal, Bruny Island, Recherche Bay, and the south of Tasmania referred to the Tiger as 'Ka-nunnah' or 'Laoonana', while tribes from Oyster Bay to Pittwater called it 'Langunta' and the North-west and Western Tribes called it 'Loarinnah' (Milligan 1859). Famous Tasmanian Aboriginal chief Mannalargenna from the East Coast of Tasmania called the thylacine 'Cab-berr-one-nen-er', while Truganinni and Worrady, (Bruny Island) called it 'Can-nen-ner'.

The thylacine is the state logo for Tasmania. The title of the journal 'Kanunnah' commemorates the Tasmanian Aboriginal word used by tribes from southern Tasmania for the thylacine.

Archer M (1974) New information about the Quaternary distribution of the thylacine (Marsupialia: Thylacinidae) in Australia. *Journal and Proceedings of the Royal Society of Western Australia* 57: 43–50.

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Vickers-Rich P, Monaghan JM, Baird RF, Rich TM (1991) *Vertebrate Palaeontology of Australasia* (Monash University Publications Committee: Melbourne).

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KANUNNAH

The Research Journal of the
Tasmanian Museum and Art Gallery

The Tasmanian Museum and Art Gallery is a combined museum, art gallery and state herbarium. It has the broadest collection range of any single institution in Australia and these collections span the arts, sciences, history and technology. The Tasmanian Museum and Art Gallery's role is to collect, conserve and interpret material evidence on the State's natural history and cultural heritage.

Kanunnah is a peer-reviewed journal published by the Tasmanian Museum and Art Gallery in Hobart, Tasmania. Its aim is to disseminate research in all areas of study undertaken by the Tasmanian Museum and Art Gallery. These areas include the life sciences, culture, history and the arts. Papers on any of these research areas will be considered, but papers dealing with Tasmanian, southern Australian and sub-Antarctic ssues will be particularly welcome.

Short communications and reviews are also welcome. Researchers based outside the institution are encouraged to submit manuscripts for publication to the journal, although they must be relevant to the Museum's primary areas of study.

Kanunnah will be published occasionally, depending upon budgetary considerations and available manuscripts.

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COVER IMAGE: *Tremolecia atrata* habit. See pp. 127–140.

Kanunnah 7: 1–188, 19 December 2014

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Statements and opinions expressed in papers in this volume reflect the views of the author(s) and are not necessarily those of the Tasmanian Museum and Art Gallery.

EDITORIAL VIEWPOINT

MUSEUM (noun) a building or place for the keeping, exhibition, education and study of objects of scientific, artistic, and historical interest.

The Tasmanian Museum and Art Gallery is a unique institution of which Tasmania can be justly proud. Included under the ambit of TMAG are the Museum, Art Gallery, and the State Herbarium, housing an incredibly diverse array of objects included in the natural and earth sciences, cultural heritage, social sciences and industrial heritage, decorative and fine arts.

In a contemporary sense, the Museum is actively involved in scientific research, education programs, in collaborative activities such as Access Art (strongly supported by Detached), MONA (Museum of Old and New Art), with artists and specialist Curators, and it has a strong community involvement through volunteers, donors and benefactors.

ART (noun) the production or expression of what is beautiful (especially visually), appealing, in a contemporary sense challenging and thought-provoking, or of more than ordinary significance.

Art is far more than just a fine painting or sculpture, the definition extending to anything beautiful or appealing or, in a modern sense, of significance.

PUBLISH (verb) to make publicly or generally known; to issue a periodical or the like, especially regularly.

While a museum or art gallery may display an array of objects, the greater proportion of most museum and gallery collections remains largely hidden from view due to lack of display space, curatorial issues, funding, and the need to regularly vary displays and create special exhibitions to maintain public interest.

Because these collections, along with the curatorial and behind-the-scenes staff, remain for the most part hidden from plain view, there is a need for the organisation and staff to acquaint the public with the extent and diversity of the collections and the vital research and curatorial work being undertaken. Faced with considerable

budgetary constraints, this can become somewhat of a challenge.

Changing displays, together with special themed exhibitions, provides much of interest to the visiting viewing public. Family days and special holiday activities help to maintain active involvement by a proportion of the public and an awareness of the Museum. Preparing and presenting such activities requires a strong commitment from staff and a considerable input of effort and time. Outside these special events, other means of increasing awareness of the Museum, its holdings, and of staff activities, need to be pursued.

KANUNNAH (thylacine or Tasmanian tiger) is the state logo for Tasmania. While *Thylacinus* is now presumed extinct in the wild, the thylacine coexisted in apparent harmony with Tasmania's indigenous people for millennia.

The first volume of *Kanunnah*, the journal of the Tasmanian Museum and Art Gallery, appeared in 2005. The journal aims to disseminate research in all areas of study undertaken by TMAG: the life sciences, culture, history and the arts. The primary purpose of the journal is the dissemination of results of staff activities, research involving collections, or of work particularly pertinent to Tasmania.

While we are living in an ever increasing technological age, there is still a vital role to be played by print media. Bill Bleathman (former Director) was a very strong supporter of *Kanunnah* and for maintaining it as a printed journal. Production costs for the journal are, in comparative terms, minimal, compared to the potential benefits of displaying any and all aspects of the work of staff, researchers, and the Museum's collections. The printed journal is critical to fulfilling this role. It is a fine, high quality peer reviewed journal and something of which staff, TMAG and, indeed, the people of Tasmania can be proud.

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CONTENTS

PILGRIMAGE TO ITALY. THE JOHN GLOVER ITALIAN JOURNEY IN 1818

Giuliana Franzini Musiani

Musiani, Giuliana Franzini, 2014. Pilgrimage to Italy. The John Glover Italian journey in 1818. *Kanunnah* 7: 1–34. ISSN 1832-536X. A detailed description and comparison of two graphic works: the Italian sketchbook n.87of John Glover, held in the Tasmanian Museum and Art Gallery (TMAG), Hobart and a coeval *album* of *Views in Italy*, 'discovered' in the collection of Mrs Jane Beckitt, which contains a selection of 39 enlargements in ink and wash from the drawings of John Glover's Italian sketchbook n.87.

Giuliana Franzini Musiani, Honorary Curator for Decorative Arts, Tasmanian Museum and Art Gallery, GPO Box 1164, Hobart, Tasmania, Australia
Email: adolfo.franzini@bigpond.com

KEY WORDS: Treasures of TMAG, John Glover Italian sketchbooks, picturesque travels, Italian landscapes in sketchbook n.87, album of Views of Italy

This paper is the result of a meticulous and detailed perusal of the Italian sketchbook of John Glover (n.87), held in the Tasmanian Museum and Art Gallery (TMAG) Hobart and of the 'development' of it in the *album: Views in Italy*, belonging to the private collection of Mrs Jane Beckitt.

The author of this essay, after reading a large number of guidebooks about Italy published between 1760 and 1835, often enriched by maps and etchings, written in several languages, and after researching into several *albums* of Italian landscapes by early 19th century artists, and into coeval travel books, with the help of her knowledge of the Italian landscape, monuments and history, has been able to reconstruct in detail the travel of John Glover from Rome to the Val di Susa in Piedmont, near the French border, and identify all the Italian places depicted by John Glover in his sketchbook. Moreover, the first three parts of this paper aim at setting the Italian travel and the Italian sketchbook of John Glover against the historical background, against the literary and artistic references, including the aesthetic theories of that age, and at pointing out the significance of what Lady Morgan called the *'Pilgrimage to Italy'* for artists and travellers in the first decades of the 19th century.

The last chapter presents the surprising 'discovery' of the *album* of *Views in Italy*, which had been seen previously by other scholars, but up till now has been neither

compared to nor connected with the sketchbook n.87. This *album*, similar to the numerous *albums* created by European artists in the 18th and 19th century, is the only one existing in the context of the artistic production of John Glover and his *entourage*. The *album*, held in the private collection of Mrs Jane Beckitt, has been kept in the heritage of her family for more than a century. This paper can be seen also in the light of a surge of interest by scholars and art lovers for the early 19th century sketchbooks, *albums* and etchings, as evidenced by several exhibitions that have been held in London, Rome and Palermo in recent time (see the bibliography).

After the 'French storm'
Italy 1818

When John Glover spent some months of the year 1818 travelling through the states of Italy with his pupil H.C. Allport, the whole country was slowly recovering from the disasters caused by the invasion of the *'French vandals'* (W. Brockedon).[1] Since 1796, the French army ravaged the Italian states with robberies, massacres and cruel repressions against peasants and citizens when they strongly reacted to the violence of the French soldiers, the same that happened in French Brittany, Charente and Vendée.

Even the Vicomte Francois-René de Chateaubriand (1768–1848), ambassador of France to the Papal Kingdom in 1828, in his recollection of the *Campagne d'Italia* (Italian wars) and wars of Napoleon, wrote:

> *La premiere invasion des Francais, à Rome, sous le Directoire, fu infame et spoliatrice; la seconde, sous l'Empire, fu inique. La Republique demanda à Rome, pour un armistice, vingt-deux millions, l'occupation de la citadelle d'Ancone, cent tableau et statues, cent manuscrits au choix des commisaires francais.*[2]

The Italian poet Carlo Porta (1775–1821) who lived in Milano at that time, in colourful and biting verses in his Milanese dialect calls the French *'quij prepotentoni'*, *'birbon'*, who *'volza I man per damen'*.[3] In 1814, after the Napoleon defeat at Waterloo, he wrote an indignant sonnet:[4]

> *... Paracar che scapee de Lombardia*
> ...
> *Ma n'avii faa mò tant voialter balloss*
> *Col ladran e copann gent sora gent*
> *Col pelann, tribolan ...*

Carlo Porta describes and remembers the French as violent robbers, for the invaders, always in need of money, imposed heavy taxes, confiscated all the silver existing in churches and houses in the Italian states, and sold off properties, masterpieces, precious manuscripts and books stolen from churches, convents, monasteries and from private collections and rich houses.

Baron Denon (Dominique Vivant Denon 1747–1825), Director of the Louvre, when travelling across Italy several times in the 1800s and inspecting monuments and art collections by order of Napoleon, selected and sent to Paris paintings, sculptures, archaeological remains and *ouvres d'art*, removed from all the Italian cities and states. Hundreds and hundreds of wagons and carriages, loaded with precious plunder, reached Paris at that time. Napoleon, by filling the Louvre with all works of art stolen from European countries and from Egypt, aimed at showing to his citizens and to the foreign nations his power and his *grandeur*.

For this reason, in the years up to 1815, despite wars and troubles, artists and travellers flocked to Paris and enjoyed the visit to what was at that time the richest and most prestigious Museum in the world. John Glover also, when he was in France in 1814, had the opportunity to see the paintings of the great masters of the past centuries and study them.

After the fall of Napoleon, however, most of the stolen masterpieces were returned to Italy. Unfortunately, a number of them had to be held in Italian museums and art galleries (e.g. Brera in Milano, created by Napoleon himself), as the places for which they had been originally conceived had been either damaged or destroyed.

In 1818 the political structure of Europe, Italy in particular, reflected the solutions of the Congress of Vienna (1814–1815); although Italy was still *'a cluster of little nations, which differ among themselves not only in manner and customs, but in government and laws, and even in dress and in language'* (Giuseppe Baretti 1719–1789),[5] many of the previously existing states had changed radically: Lombardy, Veneto and Venice became part of the Austrian empire, while the Republic of Genoa belonged to the Regno di Sardegna, and all the states had new borders, new customs rules, different currencies and laws. The economy was in poor condition, especially in the Papal Kingdom. Foreign visitors, when coming from Tuscany or Lombardy into this state, were always appalled by the large number of beggars. Many monuments, particularly convents, monasteries and churches appeared bare and dilapidated, their cloisters and chapels being transformed at that time by beggars and vagrants into shelters for themselves.

Travellers, such as Lady Morgan, Rev. John Eustace[6] and others who visited Italy around 1815–1825, described in pages full of sadness and dismay the consequences of the French invasion and the wars, which affected the Italian states for years.

Nevertheless, the landscape, the *'bel cielo di Lombardia, così bello ... così sereno, così in pace'* (A. Manzoni 1785–1873),[7] the colours of the lakes and the mountains, the glaciers, the ancient cities and their monuments and masterpieces, the splendid gardens in Roma and in the country, the 'mysterious' and silent Campagna Romana, the forests on the Apennines, all still charmed and enchanted artists and visitors, the number of whom continued to increase.

Kennst Du das Land,
wo die Zitronen bluehn ...

—J.W. Goethe[8]

Travel books, travellers and portraits of Italy after 1815

From the beginning of 19th century, travels to Italy had been made easier by the improved conditions of the roads. Napoleon, for military reasons, re-built many existing roads and opened new ones; the Moncenis Pass (altitude 2083 m) between France and Piedmont, once dangerous and very steep, had been made accessible to carts, stage-coaches and diligences, often even in winter. Consequently this pass became the shorter and easier access to Italy from France. While the guidebook *Itinerario italiano*, published in 1805, writes: *'a Lannebourg ... a piè del Mont-Cenis ... la strada cessa d'essere praticabile per le vetture, le quali si smontano, e si caricano sopra dei muli per farle passare in Piemonte'*,[9] the painter Henry Sass (1788–1844) describes in a

totally different way his trip through the Moncenis in 1817: *'the road is excellent and has a gentle ascent ...the traveller moves with ease and delight and hospitality every where prevails ... twenty-eight houses are placed at certain distances by order of Bonaparte to succour the distressed in case of need ...'* [10]

Travel books of authors such as Goethe, Stendhal, Chateaubriand, Lady Morgan and poems of Byron, Keats and Shelly, all contribute to surround Italy and its landscape with a mythical *aura* and *romantic* charm. The artists, particularly painters, often felt that their talents could really flourish and find fulfilment only when enjoying the *Italian* experience.

Italy, as well as Spain, Greece, Turkey and the Holy Land inspired authors, painters and musicians (e.g. R. de Chateaubriand *Itineraire de Paris a Jerusalem* 1811, Rossini *Le siège de Corinthe* 1826). Also, in the John Glover sketchbook n.64 (1813?), held in the State Library of New South Wales, the pages 6,7,8 depict dromedaries, figures in Oriental dress and profiles of buildings similar to the *ksars* (*forteresse-greniers*) of Southern Morocco. Camels were not unknown in Europe. W. Brockedon,[11] for example, writes that in the *porto franco* of Leghorn (Italy) wares and luggage used to be transported by camels. Nevertheless, it seems very difficult to ascertain whether J. Glover had actually seen the animals or his sketches had been rather inspired by etchings in travel books or by paintings of other artists, which is much more probable.

Artists and travellers were fascinated by the world of ruins scattered among trees, gardens and limpid waters, exotic customs and costumes, splendid, sumptuous buildings, elaborated decorations and multiform landscapes under clear skies. At that time *'non solo era di moda il Levante ... eran di moda anche le rovine, eran di moda anche le montagne'* (Mario Praz 1896–1982),[12] because all these countries, Italy in particular, offered to the visitors the remains of ancient civilizations, paysages dramatiques, glaciers in the Alps, and masterpieces in an evocative and exotic atmosphere. (**Fig. 1**)

John Glover himself, when he organised the exhibition *Descriptive of the Scenery & Customs of van Dieman's Land*, held in London in 1835, added to the Tasmanian works five paintings depicting Italian *sceneries*. According to the titles, which can be read in the catalogue of the exhibition, published by J. McPhee in his book *The art of John Glover* (see the bibliography), the Italian landscapes (n.3,5,38,53,60) are related to drawings in sketchbook n.87 and to loose sheets in the Queen Victoria Museum and Art Gallery (QVMAG) in Launceston. Nevertheless, the exhibition was not particularly successful. In fact, the taste of painters and collectors of that time, and this is only the opinion of the author of this paper, might explain better than any other reason, the lack of success of this John Glover's exhibition. In the first half of the 19th century, countries like Australia, Northern and Southern America, despite a relatively rich production of good works by local painters, had been seen by Europeans only as a field of research for scientists, botanists, explorers and adventurers, not as a source of inspiration for artists. Even Edmund Burke, in 1757, wrote: *'... barbarous temples of American at this day ... Stonehenge, neither for disposition nor ornament, has anything admirable.'* English painters, who travelled

Fig. 1. W. Brockedon. Valtournanche and Mont Cervin.
Etching 18.5 x 12.5 cm. Private collection, Italy

outside Europe, such as W. Hodges (he journeyed as draughtsman with Captain Cook) or T. and W. Daniell, who visited India, provided 'topographical' images or motives for decoration of English buildings rather than 'paintings' in the proper sense of the word. Indeed, countries so far away from Europe were 'discovered' from the artistic and literary point of view only in the second half of the 19th century by authors and artists such as H. Melville, R.L. Stevenson, G. Bizet, L. Delibes and J. Massenet, P. Gaugin, C. Ephrussi, D.H. Lawrence and others.

Since the Middle Ages, detailed guidebooks of Italy had been made available for pilgrims and travellers heading to Roma. Around the 11th and 12th century these guides were written in Latin.[14] During the Renaissance interesting books offered to artists and travellers descriptions of ancient Roman monuments and Italian geography and political conditions.[15]

In the following centuries several guidebooks had been published in European languages, especially in English, aimed at giving support and information to the travellers of the *Grand Tour.* In the 18th century, according to the taste and the style of that time, they were conceived as letters sent to friends or relatives, in which the travellers told about their travels and the places they had seen. Very often these books re-elaborated just second hand information, particularly about customs and history of the Italian states. Nevertheless, by repeating and re-writing always the same

contents for years, in some sense they contributed to 'create' the myth of Italy and of its beauty.[16]

After 1800, the style of the guidebooks altered radically, following the change of attitudes and habits of the travellers. The updated guidebooks offered to the tourists, in common prose and in various European languages, practical advice and information about passports, customs, even how to deal with the custom officers, accommodations, medicines, conditions of the states and their economy, and accurate descriptions of landscapes and monuments. Often detailed maps, indicating itineraries and main roads, were added and completed the books.

The first guidebook of this kind was the work of H.A.O. Reichard, originally written in German, but much more popular in the coeval English translation.[17] In the following years, travellers, authors, painters and archaeologists, such as M. Starke, Rev. Eustace, J. Forsyth, Nibby, E. Dodwell, (see the bibliography) published an endless number of successful guidebooks not only about Italy, but also about Greece or the Middle-East. Moreover, as readers and travellers were interested not only in monuments, but also in landscapes, nature and *folklore*, several books were enriched by etchings,[18] and several *albums*, often in large format, offered collections of *vedute pittoresche* (picturesque views) which showed the most attractive spots and details of the various regions and countries; many painters created their *vedute* in oil on canvas, copying or re-elaborating the same subjects and images, which these illustrations offered to the readers.[19] (**Fig. 2**)

Fig. 2. *The Landscape Annual for 1833.* View of Verrés in Valle d'Aosta.
ETCHING 12 X 19 CM. PRIVATE COLLECTION, TASMANIA

It is not known which guidebooks J. Glover actually used in 1818. Nevertheless, it is very difficult to agree with what is inferred in the catalogue *John Glover and the Colonial Picturesque*,[20] i.e. that John Glover probably relied either on the Northall's old fashioned guidebook, which is only a bare *resumé* of previous historical information and descriptions of some Italian cities, with no itineraries at all, or on the more detailed, but very conventional book of J. Moore,[21] which, although popular at its time, was largely out of date in 1818. It is more than likely that J. Glover had used one or some of the 'new' issues, rather than these obsolete

and old fashioned works, for several new guidebooks had been made easily available to travellers in the first 20 years of the 19th century.

Picturesque travels
Aesthetic categories, artists and their sketchbooks

After the French Revolution and the end of the Napoleonic age, taste and ideas in the artistic field changed deeply. Also, the *Grand Tour* or *Lehrjahre*, i.e. the travel through Italy, once intended as a fundamental and educational experience in the life of young artists and members of the European aristocracy, changed into *the picturesque travel*, a visit paid to a charming, colourful country by painters, authors and tourists from Northern Europe in search of evocative landscapes, different customs and costumes, worthy of being depicted and remembered. At that time, the word *picturesque*, *pittoresco*, *pittoresque* often completed the title of travel books describing Italy, especially when enriched by a large number of etchings.[22]

It must be underlined that the meaning of this word little by little evolved in the course of centuries. It seems to have been used for the first time by the Venetian art dealer and painter Marco Boschini (1631–1704),[23] to indicate 'the art of painting' of the Venetian artists. Curiously, in a totally different historical and artistic context, in an essay by T.G. Wainewright, the same word recurs in the same sense, meaning again the 'art of painting': '*... the style of Vecelli (i.e. Tiziano) is the picturesque in its proper and highest sense*'.[24]

Later, between the end of the 18th century and beginning of the 19th century, particularly among the English painters and engravers, the *Picturesque* became an aesthetic category, related to the early romantic *sensiblerie* and love for wild nature and *paysages dramatiques*, portrayed in strong contrast of light and shade, in a more 'emotional' style than the Arcadian style of Claude Lorrain's and Nicholas Poussin's landscapes, which were always pervaded by serene melancholy and motionless luminosity.[25] The treatises of W. Gilpin and U. Price formalised the principles of the *Picturesque* in painting,[26] and W. Hazlitt also referred to *Picturesque* as an aesthetic category in his essay *On Picturesque and Ideal* (1817).[27]

At the beginning of the 19th century, the *Picturesque* was not the only aesthetic approach to the fine arts and literature. In the same years the *Sublime* conception of art[28] and the *archeological* Neoclassical style largely pervaded the artistic field, with the works of H. Fuessli, W. Blake, A. Canova, J.L. David, D. Ingres, B. Thorvaldsen, J. Flaxman, L. Piermarini and L. Canonica. Nevertheless, in 1817, Stendhal declared that art should be in any case a source of emotion and beauty, regardless of the different aesthetic principles, as he writes in an emotional and high-sounding sentence that the masterpieces:

> *... sont ... ceux qui, jetant la lumière sur les profondeur du coeur humain, méttent a ma portée des beautés que mon âme est faite pour sentir ...*[29]

During the 19th century, however, the word *picturesque* lost both the original sense and the aesthetic value, merely meaning something 'curious, colourful, attractive', only because it is pleasantly unusual.[30]

Thus, painters and authors, who travelled across Italy in these years, discovered the *picturesque* not only in the woods, lakes and waterfalls, but also in the costumes of the peasants, in the sumptuous religious ceremonies, even in the beggars sitting on ruins and in the shepherds with their animals, all themes and subjects that they enjoyed to depict in their sketchbooks. Sometimes the foreign tourists, English and American in particular, always looking for *picturesque* subjects, were seen by the Italians, especially by the common people of Rome, as 'comic characters'. For example, a caustic sonnet of the Roman poet G.G. Belli (1791–1863) outlines in a satirical and 'scratching' tone the behaviour of an English tourist, *er Milordo ingrese*, looking for the *picturesque* in Rome, and, as often happened, the sceptical and cynical reaction of the locals to his funny questions.[31]

Artists and travellers of 19th century always carried pencils, brushes, water-colours and sketchbooks or *albums*, the size of which largely varied: D. Ingres and L.T. Turpin de Crissé, the Danish painters, J.A. Krafft and E. Dodwell, just to name some of them, used drawing-sheets as large as 170 mm up to 350 mm, while the British artists, such as Glover or Lord Compton and, in some cases Turner, preferred the pocket size of 100 x 150 mm or little more. The sketchbook allowed them to preserve, in their essential shapes, the details of landscapes and monuments, by which the artists had been impressed, and they liked to bring them into their own country. Once again in their *ateliers*, they developed their sketches in watercolours or paintings as, for example, did many Danish and French painters in the first half of the 19th century.[32]

At that time, rich and noble *tourists* used also to engage a professional artist, their *painter of travel*, whose duty was to depict in sketchbooks and in *albums* the various places and cities visited by his 'employer'. When both traveller and painter were back in their own country, the artist re-elaborated the drawings, creating large watercolours or oils on canvas, which were kept in the collection of his master as precious memories of their *picturesque journey*. J.R. Cozens, for example, was appointed by William Beckford (1760–1844) to paint, after a trip across Italy, a series of watercolours of Italian landscapes, now held in the Tate Gallery.[33] E. Dodwell, nobleman and painter himself, travelled across Greece in 1805–1806 with his friend and *travel-painter* S. Pomardi, producing more than 1000 drawings, 600 by Pomardi and 400 by Dodwell.[34] J. Glover himself, many years after his travel to Italy, created paintings and watercolours representing Italian landscapes, sometimes assembling parts of different sketches in an imaginary vision, such as the oils on canvas *The Temples of Paestum* or *Otricoli*. (about the *album: Views in Italy*, see the last chapter of this paper).

Although a sketchbook might be seen as *'la rarefatta espressione di un'arte che, per quanto impeccabile, resta un fatto privato''* as Professor A. Gonzalez Palacios wrote about the drawings of Lord Compton,[35] several exhibitions of sketchbooks of painters and highly educated amateurs of the early 19th century, held in the last few years, have proved how important are the preparatory drawings in the production of an artist and how easier they make the understanding of his taste, of his aesthetical ideas and of his cultural background.[36] Therefore, in

the light of the recent 're-discovery' of the *taccuini* (the sketchbooks) of artists of the 19th century, in particular English painters, once regarded by art experts as merely 'minor production' compared to their 'main' works, an accurate study about the Italian sketchbook of J. Glover seems to be of special significance and can allow scholars and historians to understand better the art and the larger creations in watercolours and in oil by this painter who, brought up in the English artistic context and in the European aesthetic theories, ended his career and his life in Tasmania.

Wandering from Rome to Moncenis
The J. Glover route and list of the drawings in his sketchbook

The Italian sketchbook of J. Glover was donated by Mrs Helen Gibson to the TMAG in 1992. It is the n. 87 in the list of the John Glover's sketchbooks.

The size of the cardboard cover is 184 mm x 124 mm, inside pages are 181 mm x 118 mm, the popular pocket-size preferred both by English professional painters such as Turner and Glover, but also by amateurs. It contains 94 pages: 72 filled by numbered drawings and 23 blank. It appears to be in passable condition: the hard cover is intact, but the spine is loose. Probably some of the pages have been removed and one page has been inserted and fixed with tape (between n.64 and n.67).

John Glover used this sketchbook, when in Italy in September and October 1818, as proved by the dates which he inscribed on the inside of the back cover. There are some isolated brown spots on the paper, which does not show watermark. Arguably, the sketchbook itself is of English production, because English travellers used to buy painting materials, sketchbooks and albums in their own country and carry them when visiting foreign countries, as several English guidebooks, such as Brockedon, always recommended. Usually the paper of many sketchbooks and albums was *wove paper*, suitable also for *guache* and watercolour, not just for pencil. The drawings are in pencil, some of them enriched by touches of grey watercolour or *guache* to create the effect of *grisaille*, and appear to comply to Gilpin's theory and technique of the shades and *chiaroscuro* in drawings. All the drawings had been numbered by the artist from n.1 to n.119.

This sketchbook is of great relevance, as it is the only known entire, although probably not intact, sketchbook of J. Glover which relates to his travel through Italy in 1818.[37] The QVMAG in Launceston holds six loose Italian drawings, depicting Roman monuments and the surroundings of Rome, Tivoli in particular. Clearly, the sheets belonged to other sketchbooks, as suggested by the fact that some of the landscapes show a number similar to the numbers in n.87.[38] All the drawings in the sketchbook refer to the return trip of J. Glover from Rome to Northern Italy and Moncenis Pass and depict with precision and deftness of touch the places by which the painter had been impressed.

Unfortunately, nothing has been discovered up till now about the route, which J. Glover followed to reach Rome. Neither letters nor sketches have been found which could actually allow suppositions about the first part of his Italian travel, nor do exist records of this artist and his pupil in the archives of Roman artistic

Fig. 3. Marco Ricci. *Landscape with peasants.*
Etching 28.8 x 42.7 cm. Private collection, Italy

associations, such as the *Accademia di San Luca* in Roma or in the collections of the *Museo di Roma* in Palazzo Braschi.[39]

In 1818 John Glover was not a young artist looking for educational emotions. He was a successful painter in his country, and his mastery of the pictorial techniques, his style and his taste were well defined and completed, as it clearly can be seen in the numerous paintings or watercolours depicting the landscapes of the Lake District and of British and European countries. Also when travelling across Italy, he was always interested in representing trees, lakes, rivers and traditional landscapes in his traditional style. Indeed, in choosing the subjects of his drawings, he still followed closely the aesthetic theory of the *Picturesque* and the dictates of Gilpin and Price: *'it is sufficient if they [i.e. the trees] are rough, mossy, with a character of age, and with sudden variations in their form. The limbs of huge trees, shattered by lightening or tempestuous winds, are in highest degree picturesque.'* [40] All the trees depicted by John Glover not only in this sketchbook, but also in oils, drawings and watercolours, reflect this vision, even more marked in the winding shapes of the eucalyptus in the Tasmanian works which he created at the end of his artistic career.

Moreover, in several of the Italian landscapes of this sketchbook a lonely, contorted tree often dominates the centre of drawings. In this case, it would be possible to see in them not only the

reflection of the Gilpin and Price treatises, but also the influence of paintings and etchings of the Venetian painters Marco Ricci (1676–1730) (**Fig. 3**) and Francesco Zuccarelli, (1702–1788), who worked for British nobles and collectors, painting landscapes animated by contorted and huge trees in the foreground or as wings or frame of a central scene. As a large number of their creations were, and still are, on display in galleries of noble English mansions, it is credible that both authors of aesthetic treatises, such as Gilpin and Price, and painters, such as Glover knew well and studied deeply these painters. Besides, it is also possible that J. Glover, when at Rome, had admired the landscapes by Gaspard Dughet (1615–1675), known also as Gaspard Poussin, *dit le Guaspe*, by Nicolas-Didier Boguet, (1755–1839), the latter called *le moderne Lorrain* by Chateaubriand.

Given the size of the drawings, and the fact that often there are two or even three landscapes depicted on the same page, it seems more than probable that he used the *black mirror* or *Claude glass*, a practice which was usual among English painters, professionals and amateurs in the 19th century and which was strongly supported by Gilpin in his treatises. The use of optical tools, especially of the *black mirror* by British artists, even when in Italy, was so common and frequent that they had been often ridiculed by colleagues of other countries in caricatures, in sketches and sometimes in satirical sonnets.

Thus, on the basis of the order of the drawings and of the landscapes which he depicted, it is possible to reconstruct the route which J. Glover had followed from Rome to the Val di Susa. This itinerary was the easiest and most popular among the foreign travellers. Often the sketches represent landscapes surrounding the *Poste*, the places in towns, in villages or along the roads where the coaches and diligences used to stop, change horses and offer accommodation and refreshment to the travellers, e.g. Covigliaio or Trofarello. Descriptions of the Poste can be found in guidebooks and journals of that time. Even authors such as Stendhal, in *Vie de Rossini*, and C. Dickens in *Pictures From Italy*, offer in their pages vivid and colourful reports of their experiences, not always pleasant, in several Italian *Poste*.

Therefore, it is a viable hypothesis that the painter and his pupil went across Italy by coach or diligence, although no letters or captions by J. Glover have been found up till now which could offer more details about the means by which he travelled.

His trip across the Italian states can be subdivided in four parts, according to the drawings on the sketchbook n.87, as follows; the numbers and the captions were inscribed in a corner of each drawing by J. Glover himself.

FIRST PART

Rome and her monuments, the little cities of the Castelli Romani and the Campagna (n.1 to n.48).

1) goats; 2) Ionic capitol and acanthus leaves; 3) cattle of *razza Chianina* common in the country around Rome. The page is smaller than the other ones and had been inserted, the colour of the paper is also darker; no number) buffaloes, these animals were half wild and largely

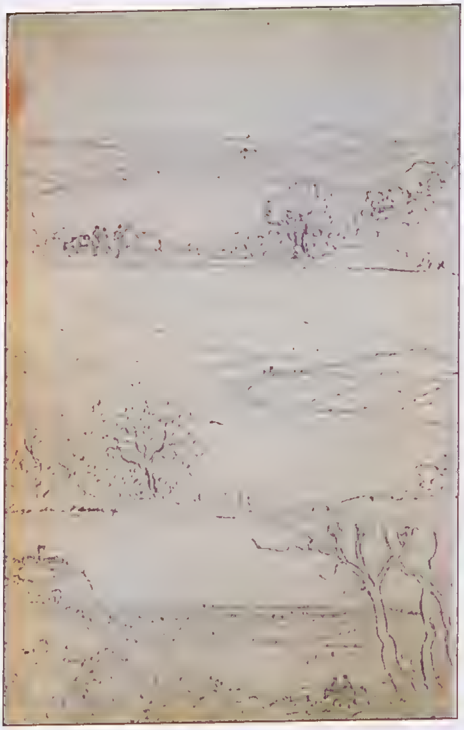


Fig. 4 (corresponds with **Fig. 16**). Three visions of the lake of Nemi (*Nami* is the J. Glover caption), animated by small figures of peasants and loaded donkeys.

Fig. 5. Peasants in local costumes (two women seated and a man standing) and a fragment of capitol.

common in *the Campagna* at that time, and vegetation; 4) *pini marittimi* (pines), the *Campagna* and profile of Frascati in the background; 5,6,7) trees, probably holm-oaks; 8) *Campagna* with building in foreground, Tivoli from Frascati?; 9–10–11–12–13–14– (no 16–) 17–18–19–20–21–22) little sketches of trees, oaks and holm-oaks of the woods near Rome, Frascati and Albano, animated by paths and figurines; no number) four little sketches, depicting women in costumes of the *Campagna*, holding the typical copper-*conca* on their head;[41] 23) profile of city of Ariccia (Glover wrote *La Riccia*), framed by trees; 24) three visions of the lake of Nemi (*Nami* is the J. Glover caption), animated by small figures of peasants and loaded donkeys. The name of the lake probably derives from Latin *nemus-nemoris* = the wood (**Fig. 4**; see also **Fig. 16**); 26) another vision of the Lago di Nemi. Curiously, J. Glover used the Italian word *lago* in his caption; 27) peasants, women and a man, in gowns of the *Campagna*, a goat and a *chianina*; 28) peasants in local costumes (two women seated and a man standing)

Fig. 6 (Corresponds with **Fig. 17**). Vision of Rome from *Monte Mario*, with Saint Peter's dome in background and pines, besides, two *chianine* and *Acanthus* leaves.

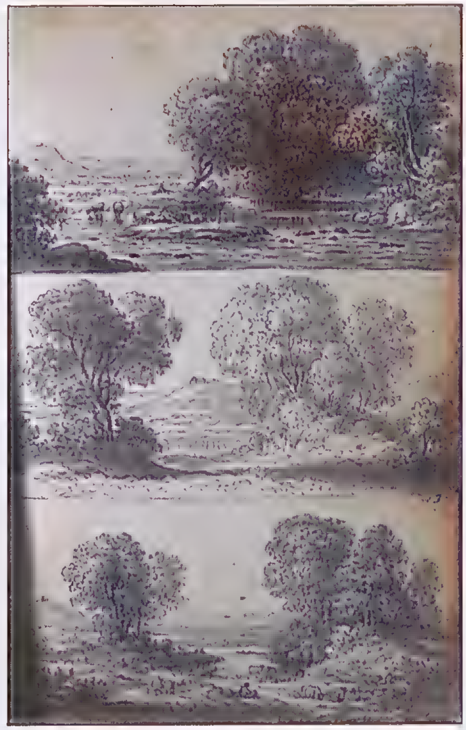


Fig. 7. Four landscapes on two pages (**Figs 6** & **7**), depicting a river, surrounded by trees, with cattle and shepherds, (caption of J. Glover, *Monte Rosi*). It is Monterosi, a small city near Viterbo, north of Rome.

and a fragment of capitol (**Fig. 5**); 29–30) Massentius basilica from the northern side, the church of San Giorgio in Velabro in the background. J. Glover wrote *Temple of Peace*, as the ruins were erroneously called at that time; 30, 31) fragments of Roman pediment; 32) Massentius Basilica, monochromatic watercolour; 33–34–35) the Colosseo from Colle Oppio and *Orti Farnesiani*, framed by oak-trees; 36) ruins of a *Ninfeo*, although the J. Glover caption is *Temple of ...*, perhaps also the remains of the Temple of Venus and Roma. Underneath, the Barock marble frame of a *Madonnella*;[42] 37) the *Colosseo* with the *Meta sudans* in foreground. The fountain was destroyed before World War II, the external part of the *Colosseo* is depicted as it was before the restoration, which added the supporting walls to the arches, some years later; 38) a sheep, women in festive costumes of the *Castelli*, a fragment of Roman frieze, a cow on the other page; 39) vision of Rome from *Monte Mario*, with Saint Peter's dome in

background and pines,[43] besides, two *chianine* and acanthus leaves (**Fig. 6**; see also **Fig. 17**); 40) *Ponte Molle*, now called *Ponte Milvio*, on the Tiber, on the next page, a walking woman, spinning with distaff and spindle, as was usual for the shepherdess in the *Campagna*; 42–43–44) four landscapes on two pages, depicting a river, surrounded by trees, with cattle and shepherds, (caption of J. Glover, *Monte Rosi*), It is Monterosi, a small city near Viterbo, north of Rome (**Fig. 7**); no number) very basic sketch, depicting the *Campagna*; 48) simple sketch, depicting probably the lake of Castelgandolfo.

Fig. 8 (Corresponds with **Figs 18 & 19**). Montefiascone, although J. Glover wrote *Orvieto*, the third drawing depicts the Bolsena's lake.

SECOND PART

Monti Volsini, Tuscia, the region of hills and lakes of volcanic origin on the border between Tuscany and Umbria and lake of Bolsena and Bracciano. John Glover used the ancient Roman *via Cassia* or also part of the *via Francigena* across the Apennines, which the pilgrims heading from Canterbury to Roma usually followed. The route is similar to the description of this area in Eustace's guidebook (n. 49 to n. 64).

49) peasants of country of Tuscia, Northern Lazio, two in elegant dresses, three ragged, a sad face of an old person, *panorama* – the J. Glover caption is *Orvieto*, but the dome could be rather related to the landscape of Montefiascone; 57–58) Montefiascone, although J. Glover wrote again *Orvieto*, the third drawing depicts the Bolsena's lake (**Fig. 8**; see also **Figs 18** & **19**); 49) Bolsena's lake and trees in foreground; 50–51) elevations and woods of the Monti Volsini in Northern Lazio, – guaches; 52–53) San Lorenzo alle grotte in Val di Lago, near Bolsena, on the *Via Francigena*, in the centre the ruins of the Renaissance church of S. Giovanni in Val di Lago;[44] 54) ruins of the church of San Giovanni in Val di Lago, framed by the entrance of one of the numerous caves both natural and due to excavations in the tufaceous hills in the area between the Monti Volsini and the lake of Bolsena, once shelters for shepherds; 55–56) the same landscape in monochromatic watercolour: ruins of the church of San Giovanni in Val di Lago, a bridge and river at Monti Volsini, both with an isolated central tree, probably a

Fig. 9. Two of six figures of fauns, on three pages, very similar to the sculptures of the *Fontana dell'Oceano*, in the Boboli garden in Florence, a work of Giambologna (1529–1608). The contortion of the bodies is typical of the *manierismo*.

chestnut, and little figures animating the landscape; 60–61) Monti Volsini, with river and trees, possibly oaks. Probably the building on the hill is the Castello di Proceno, near the lake Bolsena; 62–63) a wood, celebrated for its antiquity and beauty, on the Monti Volsini, near Bolsena, with a little figure of shepherd and cattle, described as *'un oscuro bosco, che non si taglia mai, rispettandolo come una rara antichità'*;[45] 64) six figures of fauns, on three pages, very similar to the sculptures of the *Fontana dell'Oceano*, in the Boboli garden in Florence, a work of Giambologna (1529–1608) the contortion of the bodies is typical of the *manierismo* (**Fig. 9**); No number) the following page appears to have been inserted; it depicts a lake surrounded by mountains of a sharp profile, very different from the Monti Volsini in the previous pages. Besides, J. Glover's caption is *Lake of Geneva*, which is in Switzerland. An isolated tree in foreground.

THIRD PART

The Appennines and the Pianura Padana, passage of the Futa Pass, 903 m and Raticosa Pass 968 m (n.68 to n.87).

67–68) trees and landscape of the Tuscan Appennines;. 69) large *panorama*, probably from *Le Maschere*, at *Villa Gerini*, celebrated for its lookout and beautiful view of the Santerno valley, near Covigliaio. This *Posta* lies in the Northern Appennines, between the Futa and Raticosa Pass, with its hotel built in the 17th century. At that time there was the *Dogana delle Filgare*, the border between the Papal Kingdom and the Grand Duchy of Tuscany. The road, rebuilt and enlarged in the second half of the 18th century, offered an easy access to Northern Italy. Covigliaio and Pietramala are mentioned by English guidebooks of Mrs Waldie, Eustace, Forsyth, Charlotte Eaton, all of which describe the *fuochi di Pietramala*, fires among the rocks and the woods, probably caused by underground gases or volcanic phenomena, nowadays completely disappeared, because of removals of rocks and soil; 70–71–72)

Fig. 10 (Corresponds to **Fig. 20**). Two visions of the plain, trees in foreground and profile of a city, probably near Modena or Bologna, in the background.

Fig. 11 (Corresponds to **Figs 21 & 22**). Castelguelfo di Bologna, ruins of the castle and the river Taro, with shepherds and cattle.

three different visions of the Futa pass; 73–74) the descent from the pass to the plain near Bologna and Val di Taro; 75–76) two visions of the plain, trees in foreground and profile of a city, probably near Modena or Bologna, in the background. (**Fig. 10**; see also **Fig. 20**); 77) a cow; 78) scenes of the life of peasants, three oxen-carts, commonly used to transport heavy loads, a woman carrying two water-buckets, a friar and a beggar; 79–80) Castelguelfo di Bologna, ruins of the castle and the river Taro, with shepherds and cattle (**Fig. 11**; see also **Figs 21** & **22**); 81) a little dark monochromatic watercolour: a nocturnal vision of a wood; 82–83–84) along the banks of the river Taro, the city could be Sissa (**Fig. 12**; see also **Fig. 23**); 85) along the Taro, trees and a church in the background; 86–87) profile of the Appennines in the distance, seen probably from the plain near Voghera, on the river Staffora. J. Glover erroniously wrote *Vogaro.*

Fig. 12 (Corrresponds to **Fig. 23**). Along the banks of the river Taro, the city could be Sissa.

FOURTH PART

Northern–Western Italy: Southern Piedimont and entrance of the Susa Valley. (n.88 to n.118). John Glover travelled through the Southern part of the Pianura Padana.

88–89–90) Tortona in Piedmont on the river Scrivia, the castle and an old bridge; 91–92) Piedimont: Asti and the country near Asti; 93) the river Tanaro framed by trees, Asti in the background; 94) Villafranca near Torino; 94) J.Glover incorrectly used a second time the number 94 instead of 95. 96) the Piedmont plain and the profile of the Alps in background. The mountain depicted in n.96 is probably the Monte Leone or the Fletscherhorn, near the Simplon Pass, between Italy and Switzerland. The Glover's caption is *The Simplon*; no number) This is probably a sheet belonging to another sketchbook and later inserted in n.84; 97) Asti, the town in the Piedmont plain; 98) small figures: feminine profile with the Val di Susa or Canavese bonnet, a woman with large cape, a priest, a man carrying a *gerla* on his back,[46] a man wrapped in a cape, a woman with stick and an oxen cart, transporting casks; 99–100) the mountains surrounding the Canavese valleys. 101) Trofarello, 10 km south of Torino, in the old guides called Truffarello (Glover's caption is Traffarell, see also the following chapter), the last Posta before Turin on the road from Asti to Turin (**Fig. 13**; see also **Figs 24** & **25**) 102) profile of mountains of Canavese; 103) the castle of Rivoli, near Torino, belonging to the royal family Savoia, built in the 15th century, affected by destructions and fires for centuries, finally rebuilt in 1706 by the architect Filippo Juvara, on behalf (or by order?) of the duke Vittorio Amedeo the Second of Savoia; 104) landscape near the river Dora Riparia and trees. On the left, in the background the castle of Rivoli; 105) landscape near the river Dora Riparia, trees and cattle; 106) Turin in the background, on the left the hill and the church of Superga, trees in foreground; 107) trees, mountains in the background J. Glover caption: *'A most beautiful evening effect brilliant glory of atmosphere under the Trees'*; 108) the plain near Torino; 109–110) Sant'Ambrogio di Torino, another *Posta*, at the entrance of the Valle di Susa, the river Ripa, tributary

Fig. 13 (Corresponds to **Fig. 25**). Castle of Rivoli near Turin, in the old guides called Truffarello (Glover's caption is Traffarell, the last Posta before Turin on the road from Asti to Turin.

Fig. 14 (Corresponds to **Fig. 26**). Sant'Ambrogio di Torino,another *Posta*, at the entrance of the Valle di Susa, the river Ripa, tributary of the Dora Riparia; n.110.

of the Dora Riparia; n.110, on the left, the profile of the Sacra di San Michele on the top of Monte Pirchiriano, a monastery and abbey founded in the very early Middle Ages, nearly dilapidated in 1818. Later, the monumental abbey had been properly restored and now is attended again by monks and pilgrims (**Fig. 14**; see also **Fig. 26**); 111) a wood at the entrance of the Valle di Susa, with the Sacra di san Michele and Monte Pirchiriano in the background; 112) San Giorgio in Val di Susa, on the right, the ruins the castle, destroyed by the French at the beginning of 1700 and still visible nowadays; 113) Shepherds in their traditional costumes and goats. The woman is spinning. In the background is the Sacra di San Michele. (**Fig. 15**; see also **Fig. 27**); 114–115) the little lake of Avigliana, also called *Vegliano*, ruins of the castle and trees of San Giorgio in Val di Susa. The J. Glover caption is *St. George*; 115–116–117–118) mountains near Susa, the main city in the homonymous valley, founded by the Romans in the 1st century BC; n.117: in the centre is the *Forte della Brunetta*. From Susa

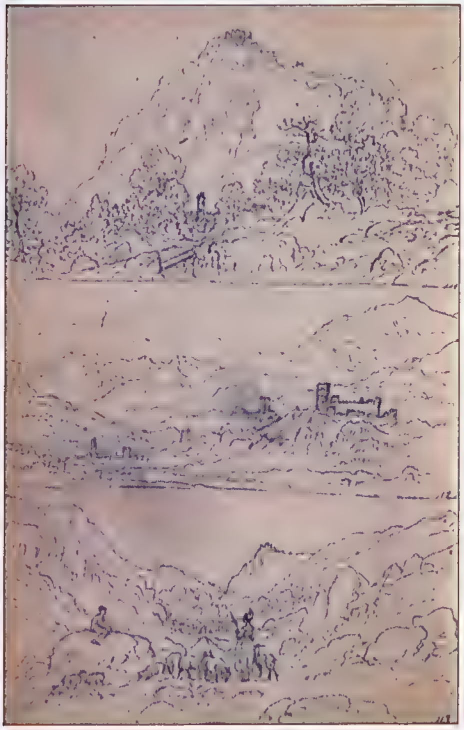


Fig. 15 (Corresponds to **Fig. 27**). Monte Pirchiriano and Sacra di San Michele. The lowest part shows shepherds in their traditional costumes and goats. The woman is spinning.

probably Glover reached France through the Moncenis pass.

The detailed perusal of the Italian sketchbook of J. Glover proves that, although the travel to Italy at his time was still intended as a sort of 'compulsory experience' by the artists, the painter himself felt little emotion when visiting Rome and Italy. He seems to have not been especially impressed by ancient monuments, as previously was pointed out by Dr D. Hansen in *John Glover and the Tasmanian Picturesque*, (see the bibliography) for his visions of Rome are conventional and often related to etchings or works of other artists, such as Hackewill or Wilson, rather than to what was experienced by the painter himself in 'discovering' buildings and ruins. Besides, in the sketchbook there a no drawings depicting monuments of other celebrated Italian cities, such as Florence, Bologna, Milano or Aosta and he seems to have been attracted only by small villages, woods and lakes. In fact, he portrayed what he used to portray, when in the Lake District, and what he later portrayed, when in Tasmania: trees as wings of a scenery or isolated in the foreground, lakes, rivers and cattle. In a sense, he seems to have looked for and painted always the same theme, regardless of the country, which he was visiting or in which he was living.

Nevertheless, in his Italian sketchbook and in other loose drawings John Glover seems to be much more inspired and spontaneous than in many of his paintings, and at the same time he appears to be a *virtuoso* of the art of drawing and of the *chiaroscuro* technique. Moreover, the Italian journey of J. Glover cannot be compared to or intended as the *Grand Tour* because, as far as it has been possible to ascertain and according to the drawings and paintings by him, at least what is known nowadays, he ignored the famous cities, in particular Venice, the must for all the foreigners among whom we can count authors such as Byron or Dickens and great artists, Turner *in primis*, who depicted the town and its colours in numberless watercolours.

In the light of what is known about the Italian experience of John Glover, it is probably more appropriate to quote what C. Coote (1893–1979) wrote when living

Fig. 16 (Corresponds with **Fig. 4**). Vision of the lake of Nemi (*Nami* is the J. Glover caption), animated by small figures of peasants and loaded donkeys.

Fig. 17 (Corresponds with **Fig. 6**). Vision of Rome from *Monte Mario*, with Saint Peter's dome in background and pines.

Fig. 18 (Corresponds with **Fig. 8**). Montefiascone, although J. Glover wrote *Orvieto.*

Fig. 19 (Corresponds with **Fig. 8**). Montefiascone, although J. Glover wrote again *Orvieto.*

Fig. 20 (Corresponds to **Fig. 10**). Vision of the plain, trees in foreground and profile of a city, probably near Modena or Bologna, in the background.

Fig. 21 (Corresponds to **Fig. 11**). Castelguelfo di Bologna, ruins of the castle and the river Taro, with shepherds and cattle.

Fig. 22 (Corresponds to Fig. 11). Castelguelfo di Bologna, ruins of the castle and the river Taro, with shepherds and cattle.

Fig. 23 (Corresponds to **Fig. 12).** Along the banks of the river Taro, the city could be Sissa.

Fig. 24 (Corresponds to **Fig. 13**). Trofarello, 10 km. south of Torino, in the old guides called Truffarello (Glover's caption is *Traffarell*, the last *Posta* before Turin on the road from Asti to Turin.

Fig. 25 (Corresponds to **Fig. 13**). Castle Rivoli near Turin, in the old guides called Truffarello (Glover's caption is *Traffarell*, the last *Posta* before Turin on the road from Asti to Turin.

Fig. 26 (Corresponds to **Fig. 14**). Sant'Ambrogio di Torino, another *Posta,* at the entrance of the Valle di Susa, the river Ripa, tributary of the Dora Riparia.

Fig. 27 (Corresponds with **Fig. 15**). Monte Pirchiriano with the Sacra di San Michele on the summit.

in Rome: *'It is a lovely run through thickets standing high above mossy banks, between which the road wanders like a Devonshire lane. It is curious how we travel thousands of miles in order to find scenes akin to those outside our backdoor.'* [47]

THE *ALBUM* OF *VIEWS OF ITALY*
Its contents and the problem of the artist, who created it.

In the private collection of Mrs Jane Beckitt, who kindly allowed the author of this paper to peruse and study it, there is a work, which can be defined *album di vedute* (selection of views), strictly connected with the John Glover's Italian sketchbook n.87. In fact, this *album* contains 39 pages which reproduce in a very faithful and accurate way a selection of landscapes from the sketchbook n.87.[48] While the drawings of sketchbook n.87 are all in pencil, the enlarged landscapes forming the *album* are depicted in ink and grey-brown or *sepia* wash (**Figs 16–27**). The *album* was given as a present by the members of the Latrobe, Launceston and Scottsdale Union Bank branches to Mr John Townsend-Sale when he retired from his position in 1890 [49] and has been held by the descendants of Mr Townsend-Sale in the family's collection for more than one hundred years.

This *album* cannot be defined a 'sketch-book', as it is not what usually a sketch-book was and still is, i.e., a collection of 'pictorial notes' taken by a professional artist or even by an amateur, particularly women, when either travelling, visiting a town or attending an event. It is rather an actual *collection* of selected views copied and assembled on purpose, as the following description of its contents aims at proving.

The *album* is 195 mm in length, by 130 mm in width, has a cover in dark brown cardboard, and contains 39 sheets (170 mm x 120 mm), numbered from 1 to 44. Unfortunately, the sheets n.5–6–7–8–12 are missing. On each sheet an Italian landscape is depicted in ink and monochromatic grey-brown wash, framed by a thin line in black ink and a blank margin of about 10 mm x 5mm. The landscapes in the *album* reproduce in an absolutely faithful way, even in the minor details, the originals in pencil from the John Glover's sketchbook n.87. The spine is loose. The paper and the washes are in good condition, only the margins of the pages show a light brown shade, due to the age and the quality of the paper (no watermark), which is *wove paper* suitable to wash and watercolour.

Each image holds outside of the thin ink-frame a number from 1 to 44 on the top right corner, on the left bottom corner are two numbers, e.g.24/87: the first of them indicates the number of the corresponding John Glover's drawing in his sketchbook, the latter, always 87, is the number of John Glover's Italian sketchbook, which contains the originals. A handwritten caption is inscribed beneath some of the landscapes, when the caption, obviously the same, had been written by John Glover on the model-drawing in n.87. The names and even the spelling errors are identical. All the sketches in sketchbook n.87, which were reproduced in the *album*, held a little cross in pencil near the number given to them by John Glover himself (see the previous chapter of this paper).

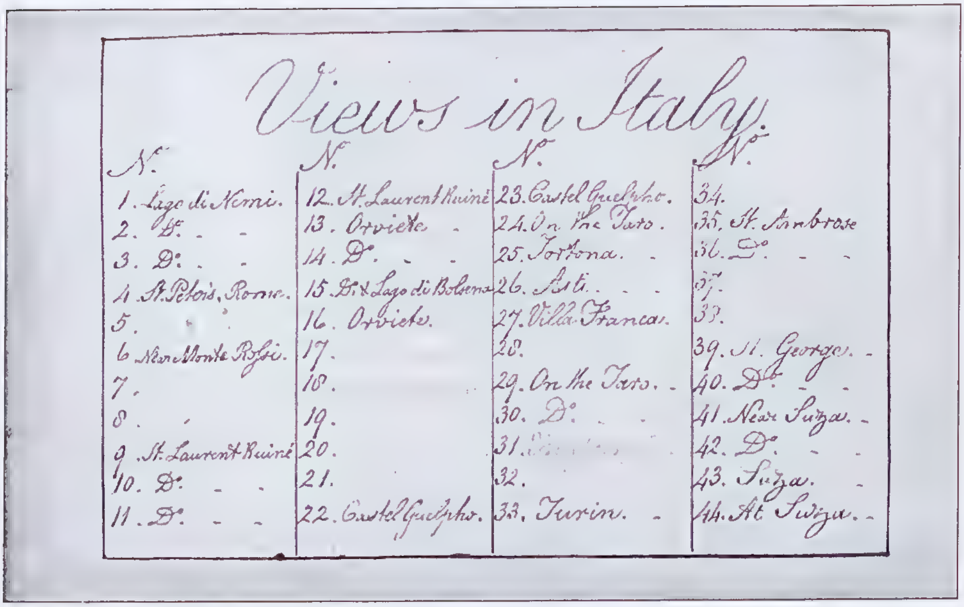
Table 1. Album page numbers and corresponding sketchbook n.87 drawings.

ALBUM (Private Collection) Page Number	SKETCHBOOK n.84 (TMAG) Drawing Number
1	24
2	25
3	26
4	39
5,6,7,8 missing	
9	52
10	53
11	54
12 missing	
13	57
14	58
15	59
16	60
17	68
18	70
19	71
20	72
21	75
22	79
23	80
24	82
25	88
26	93
27	94
28	99
29	83
30	84
31	101
32	103
33	106
34	107
35	109
36	110
37	111
38	112
39	114
40	118
41	116
42	117
43	118
44	119

Table 1 shows the identification of the identical subjects in the *album* and the sketchbook. (As for the subjects in sketchbook n.87, see the drawings numbers in the previous chapter).

There is no title page. A title page with description of the contents, date and name of the artist – sometimes a dedication – was usual for works of this kind, both printed or hand painted. In this case, it is impossible to know whether this page originally existed and is missing. Nevertheless, the loss of other pages might support the supposition that originally a title page existed, but, like others, did not survive.

Moreover, the uniformity of the illustrations, the ink-frame around the landscapes, the *formal* hand-writing of the captions, the index, all these details



Views in Italy.

N°.	N°.	N°.	N°.
1. Lago di Nemi.	12. St. Laurent Ruine	23. Castel Guelpho.	34.
2. D°.	13. Orvieto	24. On the Taro.	35. St. Ambrose
3. D°.	14. D°.	25. Tortona.	36. D°.
4. St. Peter's, Rome.	15. D° & Lago di Bolsena	26. Asti.	37.
5.	16. Orvieto.	27. Villa Franca.	38.
6. Near Monte Rossi.	17.	28.	39. St. Georges.
7.	18.	29. On the Taro.	40. D°.
8.	19.	30. D°.	41. Near Suza.
9. St. Laurent Ruine	20.	31. [illegible]	42. D°.
10. D°.	21.	32.	43. Suza.
11. D°.	22. Castel Guelpho.	33. Turin.	44. At Suza.

Fig. 28. Handwritten index, showing the title: *Views in Italy* and the numbered list of the landscapes on inside of the back cover of the Album.

clearly prove that this was conceived as an *album* to be kept, sold or reproduced in etchings. In this case a title page was, so to say, 'compulsory' or usual. *Album di vedute* (Selection of views) with views of monuments of Italian towns, particularly Rome, or landscapes of countries such as Italy, Greece or Turkey, always holding a title page, were very popular in the 18th and 19th century. They were easily available, both the more expensive hand painted ones and others, more affordable, containing etchings or chromolithographs. Since the second half of the 19th century, little by little the *albums of photographs* ousted watercolours and etchings, at the beginning because they were the most *modern* kind of *souvenir* and then because a number of copies became available for travellers and collectors, often at a very reasonable price.

On the inside part of the back cover there is a handwritten index, showing the title: *Views in Italy* and the numbered list of the landscapes (**Fig. 28**). The captions, where they have been written beneath the landscape itself, appear also in the index. It is still unknown for which purpose the *album* had been created and on which basis the subjects, less than the half of the original drawings in n.87, had been chosen.

Certainly, the *album* was conceived and realised in the peaceful atmosphere of an *atelier*, most possibly in Tasmania, because the number 87 inscribed on each page of the *album* was given to the John Glover's Italian sketchbook years later after the

Italian *tour* in 1818, perhaps after the artist moved to Tasmania with his older son John Richardson Glover.[50] Arguably, the landscapes were reproduced from n.87 by the help of an optical instrument, because the images are identical even in the minor details and differ only in the size.

This *album* was well known in the QVMAG in Launceston, in the Australian National Gallery (ANG) in Canberra, as well as by authoritative scholars such as John McPhee who, in 1977 after inspecting this work, called the *album 'John Glover Sketchbook'*. He published two pages of it in his book *The Art of John Glover*, p. 21, as a work of J. Glover himself. (The date 1818 must be referred to as the year of the travel, not as the date of the *Album*).

Then, in 1980–1982, the *album* had been lent to the ANG to assist Tim Bonyhady, at that time Curatorial Assistant at the same Gallery, in his research into John Glover's paintings. Moreover, in the two letters sent to Mrs Mary Swan, who owned the 'sketchbook', by Tim Bonyhady and Daniel Thomas, the work is again called 'the John Glover sketchbook'.[51] These scholars, as well as John McPhee, believed that the *album: Views in Italy* was the only one related to the John Glover Italian travel because they had no opportunity to compare the two books of drawings, as at that time (1970–1980s) the n.87 was not yet in the collections of the TMAG. Besides, the handwriting of numbers, index and captions presents the same features of the handwriting of John Glover in the sketchbook n.87, e.g. the letters N and T are identical, the word *Troffarel* followed by a question mark is the same in the two works. The trees depicted in the *album*, defined in their shape by thin, curled touches of ink are not different from what can be seen in loose sheets and washes signed by John Glover.[52]

On the *verso* of the sketch n.24 the following words can be read: *From the Italian Sketch Book by John R. Glover.* (John Richardson Glover, also called junior John Glover). There is neither date nor signature on the page, but according to the style of the writing these words appear to have been written at a later date and in a not too accurate or hasty way. It would be difficult to understand why the anonymous person wrote 'from the sketch book ...', as the *album* itself is a book of drawings. It is possible that the person who wrote these words either intended to refer to the single sheet or had mistaken the name of the recipient of the Italian sketchbook from the name of the artist who created the *album*.[53] Besides, the handwriting of John Richardson Glover, at least according to what can be gathered from a perusal of *Annoted panoramic Plan of "Patterndale" Farm*[53] and in the captions of the *Evandale Sketchbook* (see bibliography), is different both from the handwriting of the n.87 and from the handwriting of the *album*.

Although there are neither name of the artist nor signature in the *album*, on the basis of the opinions of authoritative scholars such as John McPhee and Tim Bonyhady, on the previous remarks about the handwriting, and on the fact that the only reference to John Richardson Glover are the unsigned words written on the *verso* of one of the sheets, it is possible to gather and infer that the *album* is a work of John Glover senior.

This *album* of *Views in Italy* is of great significance in the context of the works

by John Glover, because it can be seen as a very faithful 'development' of the original n.87 and a unique creation in the context of the Glover's artistic production. It seems to prove that the artist never forgot his travel across mountains, lakes and woods of Italy and that even after many years the Italian landscapes were to him a source of inspiration, which often ended up in large oil paintings, as the works sent to the exhibition in London in 1835 (see 'Kennst Du ...' p. 3). Besides, the two *cahiers* – the sketchbook n.87 and the *album* – are the only two 'graphic witnesses' of the Italian experience by the English-Tasmanian artist, which have been preserved almost intact, as a heritage for modern scholars and art-lovers.

Acknowledgements

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Endnotes

1 William Brockedon *Traveller's Guide to Italy or Road Book From London to Naples* London, Baudry's European Library, 1835 p. 162.

2 Francois René de Chateaubriand *Memoires d'outre-tombe* Paris, Garnier, 1998 4 vols, vol. 3 p. 411.

3 Carlo Porta *I desgrazzi de Gioanin Bongée* passim in *Poesie a cura di Dante Isella* Milano, Mondadori, 1975 p. 60 'these awful bullies, rascals ... use their hands to cudgel ...'.

4 Sonnet 22, ibidem 'kerbstone (the disparaging nickname given to the French invaders in Milano), who run away from Lombardy ... you acted so cruelly, you knaves, stealing, killing lots of people, flaying us with taxes and confiscating and torturing us ...'.

5 Giuseppe Baretti *An Account of the Manners and Customs of Italy* London, Davies 1768 2 vols vol. 1, p. 14.

6 Lady Morgan *Italy* London, Colburn 1821 3 vols and Rev. John C. Eustace *A Classical Tour Through Italy* 3th edn. revised and enlarged London, Mowman, 1815 3 vols.

7 Alessandro Manzoni *I promessi sposi* 1st edn. 1825–1827 in *Tutte le opere a cura di A. Chiari e F. Ghisalberti* Milano, Mondadori, 1959 p. 6 'the beautiful sky of Lombardy ... so fine, so clear, so peaceful ...'.

8 Johann Wolfgang Goethe *Wilhelm Meister Lehrjahre (1794)* Buch III, Band 1. Muenchen, Insel Verlag, 2009.

9 *Itinerario italiano* Firenze, Tofani, 1805 4th edn, p. 97 'at Lanslebourg ... on the foot of Moncenis Pass the road is not accessible to the coaches, they must be disamblassed, carried by mules and brought into Piedmont'.

10 Henry Sass *A Journey to Rome and Naples Performed in 1817* pp. 52–54 passim.
11 See note n.1.
12 Mario Praz *Il patto col serpente* Milano, Leonardo, 1972 p. 55 '... not just the Middle-East was fashionable ... fashionable were the ruins, fashionable were the mountains ...'.
13 Edmund Burke *A Philosophical Enquiry Into the Origin of Our Ideas of the Sublime and Beautiful* London, Dodsley 1757, published anonymous, pp. 44 & 60
14 For example the guidebook of 11th century *Mirabilia urbis Romae,* incunabulum as *editio princeps,* no date, but probably 1485.
15 Anonymous *Antiquarie prospetiche romane a cura di G. Agosti e D. Isella* Parma, Guanda, 2004 a poem composed at the end of 1400 AD, illustrating the ruins of Roma, or Leandro Alberti *Descrittione di tutta Italia* Venezia, Bonelli 1553 2nd edn. or Flavio Biondo *Roma ristaurata e illustrata* Venezia, Giglio, 1558, Italian translation from the original Latin.
16 John Northall *Travels Through Italy* London, Hoper, 1766 or John Moore *A View of Society and Manners in Italy* London, Strahan, 1781 or Samuel Sharp *Letters from Italy* London, Cave, 1767 against whom Baretti argued very deeply.
17 Ottokar Reichard *Itinerary of Italy or Traveller's Guide Through That Interesting Country* London, Leight, 1819. One of the W.M. Turner sketchbooks held in the Tate Gallery contains notes and comments by the painter about this guide, which evidently he used when he visited Italy for the first time in 1819.
18 James Hackewill *A Picturesque Tour of Italy from Drawings Made in 1816–1817* London, Murray, 1820. A sketchbook of Turner, held in the Tate Gallery, is full of notes about the Hakewill book. Another example is: Antoine-Laurent Castellan *Letters on Italy, Illustrated by Engravings* London, Phillips, 1820, which is the coeval English translation of the original in French. The poem *Italy* by Samuel Rogers (1763–1855) was nearly ignored by the readers when published anonymously in 1822, but a luxury edition of the same work, enriched with illustrations by W.M. Turner, Stothard, Prout and other famous painters, published in 1830, immediately became a successful book, a sort of 'decoration' of drawing rooms and a very sought after present for educated English travellers.
19 J.F. Ostenwald & G. Lory *Voyage pittoresque de Genève àMilan* Paris, Didot, 1811, L. Rossini *Viaggio pittoresco da Roma a Napoli* Roma, Rossini, e Scutellari, 1839, or W. Brockedon *Illustration of the Passes of the* Alps London, Brokedon, 1829, 2 vols. (see illustration n.1)
20 David Hansen *John Glover and the Colonial Picturesque* Hobart, TMAG, 2003 p. 68. Catalogue of the exhibition held at TMAG, Hobart in 2003.
21 See note n.16.
22 See the previous chapter and the bibliography at the end of this essay.
23 M. Boschini *La carta del navegar pitoresco* (1660), a long poem in Venetian dialect, and *I gioielli pittoreschi* (1676) in Italian language, both the works aimed to extolling the art of the Venetian painters, such as Giorgione, Tiziano, Veronese ... compared to the Tuscan artists supported by Vasari.
24 T.G. Wainewright in his essay *'Janus Weatheckok Reason ...'* in the *London* magazine, June 1822.
25 Walter Pater, in 1886 recreated the atmosphere of the landscapes depicted by C. Gellee` *dit Le Lorrain* in one of his *Imaginary portraits :Denis L'Auxerrois* . The style of Gaspard Duguet *dit Le Guaspe,* called also Gaspard Poussin, as well as the paintings of Salvator Rosa and Clause-Joseph Vernet seem to be more *dramatiques* and to have influenced the taste and the style of *Picturesque.*
26 W. Gilpin *Three Essays on Picturesque Beauty;on Picturesque Travel;on Sketching Landscape* London, Blamire, 1792 and U. Price *Essay on Picturesque* London, Hereford, 1798, 2 vols. John Glover knew very well the Price's book, as proved by the copy of it held in his library at Evandale and now in the QVMAG Launceston.
27 In *Table talk or Original Essays* London,Dent, 1908 p.317
28 The idea of *Sublime* was in part related to the treatise of E. Burke *A Philosophical Enquiry into the Origin of Ideas of the Sublime and Beautiful* London, Dodsley, 1757, which discuss mostly poetry, inserting several quotations of Homer and Vergil. H. Fuessli in *Aphorism, chiefly Relative to Fine Art,* (published posthumous by J. Knowles *The Life and Writings of Henry Fuseli* London, Colburn and Bently, 1831 3 vols), and in *Lectures on Paintings* (in *Lectures on Paintings by the Royal Academician Barry,Opie and Fusely* London, Bohn, 1848)re-elaborated the idea of *sublime* related to the art of painting.
29 In *Histoire de la peinture en Italie .(1817)* Paris, Gallimard,1996 p.232
30 M. Twain wrote: *'the gondolier is a picturesque rascal ...'* in *The Innocent Abroad* (1869) and even *'Australian history is almost always picturesque ...'* in *More Tramps Abroad (*1897). G. Simenon told of the *"caractère pittoresque"* of a snapshot in *L'entérrement de Monsieur Bouvet,* (1960) or E. Bramah of *"the aimless search for picturesque"* of the English tourists, travelling across Europe in *The Game Played In Dark* (1900)
31 G.G. Belli *Er zervitor-de-piazza, er Milordo ingrese, e er vetturino a nolito* (1831) in G.G.Belli *I sonetti* Milano, Feltrinelli, 1976, 4 vols. p.220
32 C.W. Eckersberg, C. Hansen,T. Lund and others spent long time in Rome, painting and drawing. Many of their works are held in Danish museums.

33 The Tate Gallery acquired seven sketchbooks of J. Cozens, auctioned by Sotheby's in November 1973, which are the original of the watercolours existing in the Beckford collection.

34 The exhibition *La riscoperta dell'antico. Gli acquarelli di Edward Dodwell e Simone Pomardi,* a selection of 38 of these drawings and watercolours has been held in London and then in Rome in 2013.

35 Alvár González Palácios *La Sicilia di Lord Compton* article in the Italian newspaper *Il Sole 24 ore* December 2013 about the exhibition *Viaggio in Sicilia. Il taccuino di J.A.Compton* held in Rome and Palermo in 2013–2014. see also the bibliography. '(the drawings) are the rarefied exhibition of an art that, although faultless, is only a private matter'.

36 *Disegni romani di L.T. Turpin de Crissé (1782–1859) dalle collezioni del Louvre* held in the Museo Mario Praz, Rome in 2009–2010; *Documenti del Grand Tour, I taccuini del fondo Consoni* Roma 2011, *Luoghi comuni: vedutisti inglesi a Roma tra il XVIII e il XIX secolo,* held in Rome Palazzo Braschi, in 2013; see also notes 34 & 35.

37 There are no sketches or documents which can prove that J.Glover, as noted also by D.Hansen, travelled farther than Rome and her surrounds. The painting *The temples of Paestum* (near Salerno, in Campania) was probably inspired by an etching in the S. Rogers book (1830) – see note n.18. What J. McPhee wrote about the Italian travel of the painter: *'he visited remote parts of Southern Italy and even ventured to Sicily'* (in *The art of John Glover* p. 16) is a mere supposition, not supported by any document, prove or drawing, and seems to be not acceptable.

38 The QVMAG put them on display, completed by captions, in September 2013, and a lecture *Garden of Ruins. The Italian Sketchbook of John Glover* was held at the QVMAG the 22 September 2013 by the author of this paper.

39 The *Accademia di San Luca* is one of the oldest and most important European artistic associations. The author of this essay spent time in Rome in May 2013, researching into archives and records of this and other *Accademie*, but no mention of J. Glover has been found.

40 U. Price *An Essay on Picturesque, Compared with the Sublime and Beautiful* London, Robson, 1796 p. 70.

41 The *conca* was the container in copper in which the women used to carry the water, always well balanced on their head. As a consequence, these women have been celebrated for the elegance of their stately walk.

42 The same monument, with the caption *Vue du Temple du Soleil et de la Lune,* had been portraited by F.M. Granet and Lancelot-Turpin de Crissé in 1808, and in the *album* of L.Rossini, 1817. They are the remains of the temple of Venus and Roma. The *Madonnelle,* called *santelle* in Northern Italy, are shrines, usually a Madonna-fresco surrounded by an elaborated marble frame, built high on a corner or on a wall of a house or a *palazzo* along the streets, holding a little burning latern. In the past centuries they were the only lights in the streets of Rome and other cities. Most of them still exist, although often in poor condition.

43 This vision is similar to several other paintings, e.g. by R. Wilson. This drawing is the initial sketch of the J.Glover oil on canvas *Roma with Saint Peter and Castel Sant'Angelo* (1821), held in the National Gallery of Australia.

44 A painting by J.Glover: *The ruins of San Lorenzo Vecchio near Bolsena*, (1824), depicting nearly the same landscape, has been recently auctioned in England. Another one of the same subject is held in the National Gallery of Australia, Canberra.

45 In the guidebook *Itinerario italiano* p. 170 – see bibliography – which strongly recommends to pay a visit to this forest, because of its beauty.

46 The *gerla* or pannier, made by thin strips of soft wood interlaced in conic shape was the most common container used, as a modern rucksack, by people living on the mountains to carry any kind of items, from wood to food and other. It was still in use till up to the 1960s.

47 C. Coote *In and About Rome* (1926) p. 134.

48 No investigations or study has been conducted on this work, although, according to Mrs Beckitt, the TMAG had been told about it not many years ago.

49 John Townsend Sale (1832–1912) was born in England and moved into Australia in 1858. He held an important position in the Union Bank, from which he retired in 1890.He died at Launceston, aged 80. He was the father of Mrs Blanche Sale, married Swan. Mrs Jane Beckitt, and Mr Ian Swan are her descendant. That means that the *album* has been kept in the heritage of the family for more than one hundred years.

50 Exhaustive information about the sketchbooks of John Glover can be find in the essay by M. Staples *Sunshine and Shadow* in *J.Glover and The Tasmanian Picturesque* pp. 262–264. Mr Staples says that *'somebody wrote the number inside the front cover of each sketchbook'*, but no further investigations seems to have been done on the *somebody* and on the handwriting .After comparing the handwriting of the numbers and the capital letters of John Glover in other sketchbooks, in particular the n.97, the author of this paper is inclined to think that the painter himself wrote the numbers and the initials of the recipients in his sketchbooks.

51 A form dated 23 June 1977, filled and signed by John McPhee, declares that the *'John Glover sketchbook is on loan from Mrs M. Swan'* in the Queen Victoria Museum in Launceston. A letters dated 16 April 1980, signed by Tim Bonyhady of

Australian National Gallery in Canberra, sent to Mrs M. Swan, quotes the same *album 'John McPhee informs me that you have a sketchbook by Glover with views of Italy'*, and a letter (23 march 1981) signed by Tim Bonyhady says: *'Your John Glover sketchbook of Italian views which you loaned to the Australian National Gallery on 5 March 1981 arrived safely to the Gallery'*, besides another letter (21 January 1982) to Mrs Mary Swan, signed by Daniel Thomas, Senior Curator of Australian Art at the Australian National Gallery, mentions the same *album 'Your John Glover sketchbook, generously lent to the Australian National Gallery to assist Tim Bonyhady's research into some of our paintings by Glover ...'* Mrs Mary Swan was a descendent of Mr J. Townsens-Sale and the grandmother of Mrs Jane Beckitt. J. McPhee published the two pages of the *album* in p. 21 of the volume *The Art of John Glover.* The date 1818 in the captions must be referred to the year of the Italian travel of the painter, certainly not to the composition of the *album.*

52 e.g. *Ullswater* held in the TMAG, n.50, p. 182 of the D. Hansen's mentioned catalogue.

53 About the sketchbooks and the intended recipient, see what M. Staples *ibidem* . p. 263

54 See the illustration p. 95 in D. Hansen *John Glover and the Tasmanian Picturesque.*

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THE HISTORY OF THE REINSTATEMENT OF *UTRICULARIA UNIFLORA* R.BR. IN TASMANIA, THROUGH A MARGARET STONES WATERCOLOUR

Miguel F. de Salas

de Salas, Miguel, 2014. The history of the reinstatement of *Utricularia uniflora* R.Br. in Tasmania, through a Margaret Stones watercolour. *Kanunnah* 7: 35–39. ISSN 1832-536X. Despite having a difficult taxonomic history, a watercolour painted by renowned botanical illustrator Margaret Stones led to the rediscovery and reinstatement of the bladderwort species *Utricularia uniflora* in Tasmania.

Miguel de Salas, Tasmanian Herbarium, Tasmanian Museum and Art Gallery.
PO Box 5058, UTAS LPO, Sandy Bay, Tasmania 7005, Australia.
Email: Miguel.deSalas@tmag.tas.gov.au

KEY WORDS: Bladderwort, watercolour, Lentibulariaceae, *Utricularia uniflora*, Margaret Stones, Tasmania

The genus *Utricularia* contains those carnivorous plants commonly known as 'bladderworts', and in Tasmania also as 'fairy aprons'. It is one of only two genera of carnivorous plants present in Tasmania, and it is characterised by its delicate, orchid-like flowers and mostly-underground vegetative parts.

The pink-coloured Tasmanian species *Utricularia uniflora* R.Br. was described by renowned Scottish botanist Robert Brown (1810). Fifty eight years later, George Bentham (1868) decided to reduce it to the rank of variety, as *U. dichotoma* var. *uniflora* (R.Br.) Benth. Later authors have tended to follow Bentham, or ignored the variety altogether and treated it as part of the broader variation within *U. dichotoma* Labill. For example, Rodway (1903) was non-commital and commented that 'The 1-flowered form has been described as a distinct species, *U. uniflora* Hook [sic]'. Rodway's treatment exemplifies how, after Bentham's interpretation, many authors unfortunately used the name *U. dichotoma* var. *uniflora* for single-flowered forms of *U. dichotoma* Labill. *sensu stricto*, rather than for the taxon described by Brown. Curtis (1967) treated *U. uniflora* as a synonym of *U. dichotoma*, but speculated that it may warrant separate recognition. This confusion stems in a large part from the delicate nature of *Utricularia* flowers, which unfortunately don't retain critical details of their three-dimensional shape and colour after pressing and drying.

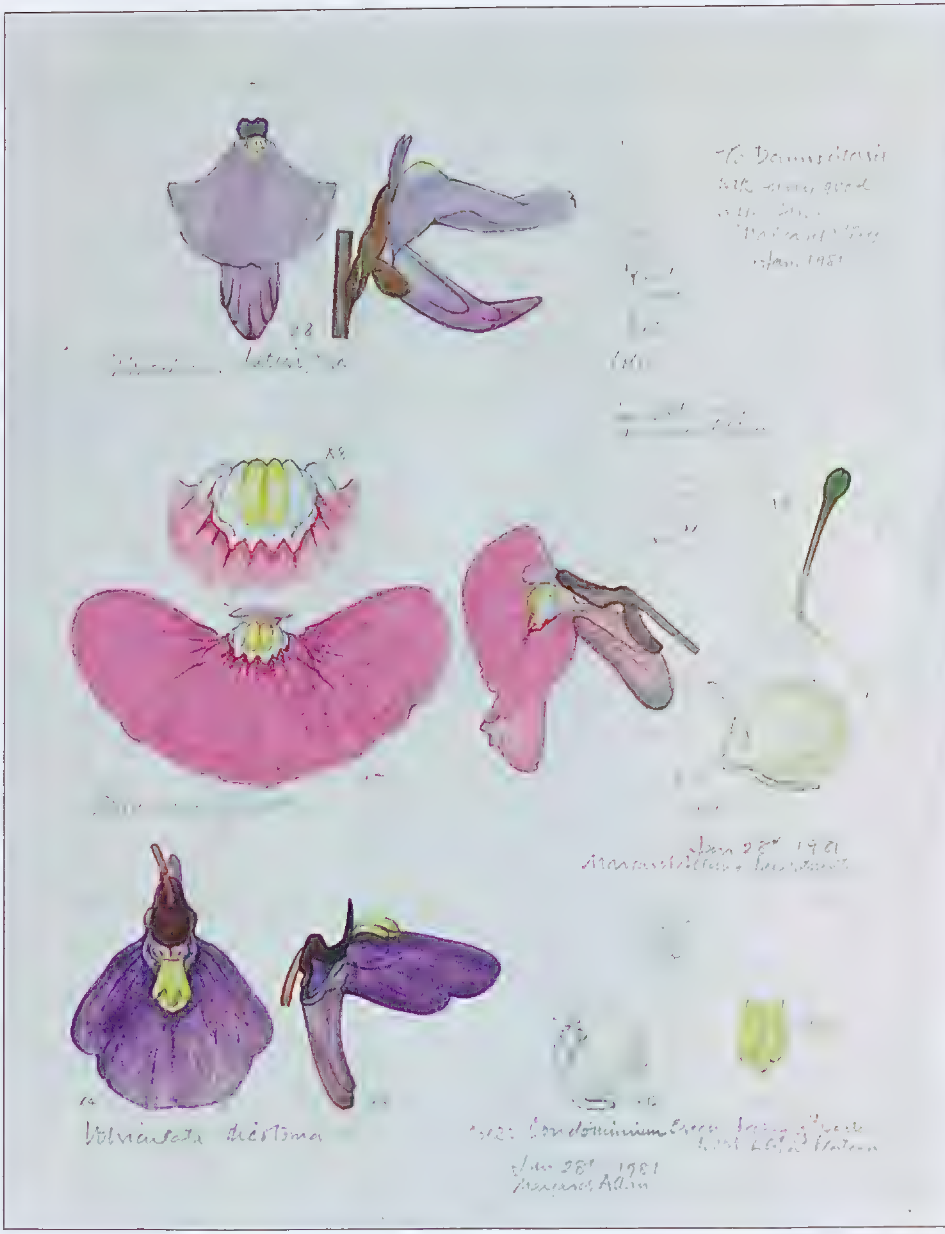

Fig. 1. Original watercolour of three *Utricularia* species by Margaret Stones, collected by Margaret Allan on 28 January 1981.

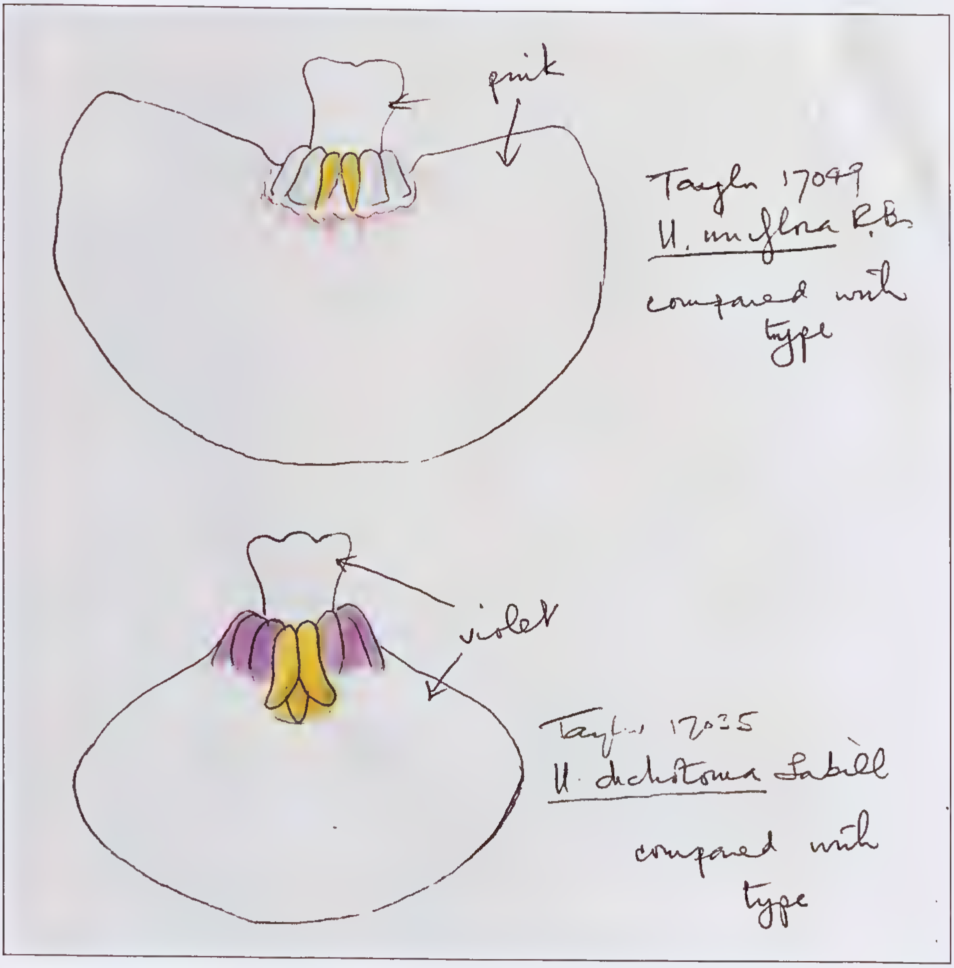

Fig. 2. Pen and watercolour sketch by Peter Taylor, illustrating the diagnostic differences between *Utricularia uniflora* and *U. dichotoma*.

This taxonomic confusion was prevalent in 1981, when a pink-flowered *Utricularia* from Condominium Creek in Tasmania's south-west, was collected by the late Margaret Allan and Margaret Stones on 28 January. Margaret Allan was a local botanical enthusiast, a member of the Society for Growing Australian Plants, and one of the dedicated collectors who were instrumental in gathering the material that Margaret Stones and Winifred Curtis (1967–1978) had used to write *The Endemic Flora of Tasmania*, a six-volume joint project. Margaret Stones, who is today widely considered to be one of the world's foremost botanical artists, was a principal contributing artist to *Curtis's Botanical Magazine*; *The Endemic Flora of Tasmania* is possibly her most

sought-after work. Her co-author, the late Dr Winifred Curtis, was one of Tasmania's leading botanists, several times acting head of the Botany Department of the University of Tasmania, and author of the *Student's Flora of Tasmania*, in addition to many other publications from 1931 to 1994. One of her closest collaborators was the late Dr Dennis Morris, her co-author in later editions of the *Student's Flora*, and her colleague at the Tasmanian Herbarium. Margaret Allan and Margaret Stones recognised their pink *Utricularia* as something different, and submitted it to the Tasmanian Herbarium (where it is still held under the registration number HO40273), together with an exquisite watercolour of this collection and two other *Utricularia* specimens collected in the same day and general area, and painted by Margaret Stones (**Fig. 1**).

The foremost expert on *Utricularia* at the time was Dr Peter Taylor, working at the Royal Botanic Gardens in Kew. He heard of the pink-flowered *Utricularia* from Margaret Stones, who was also based at Kew, and enquired of Dr Morris at the Tasmanian Herbarium whether this collection was of *Utricularia tenella* R.Br., which was at the time known from the Bass Strait islands but not mainland Tasmania. Herbarium correspondence shows that Dennis Morris was aware this species was not *U. tenella*, and he considered it likely to be something as yet undescribed. He forwarded specimens and drawings, including Margaret Stones' watercolour, to Dr Taylor at Kew for further work. The quality and botanical accuracy of the watercolour was such that Peter Taylor was immediately able to identify it as *Utricularia uniflora*, and that it was clearly not conspecific with *Utricularia dichotoma*. He returned the watercolour and some of his own field sketches that detailed how to differentiate the two species (**Fig. 2**).

Taylor's subsequent monograph (1989) finally established the distinct status of both species, and the morphological characters that could be used to distinguish them unambiguously. Margaret Allan's collection and Margaret Stones' watercolour thus directly triggered the modern recognition of this beautiful component of the Tasmanian flora.

Acknowledgements

The author would like to thank Maria McDermott for photographing Margaret Stones' and Peter Taylor's illustrations, as well as Dr Gintaras Kantvilas and Lyn Cave for constructive commentary and review of this manuscript.

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THE TALBOT COLLECTION: AN APPRECIATION

David Rampling

Rampling, D.J., 2014. The Talbot collection: an appreciation. *Kanunnah* 7: 40–53. ISSN 1832-536X. The Tasmanian Museum and Art Gallery (TMAG) has a large and significant numismatic collection that was considerably augmented by a gift of coins and medals belonging to the late Lord Milo Talbot de Malahide. This paper traces the personal associations and enrichments that accompanied an examination of the small Scottish component of the Talbot collection. I have drawn on a number of sources in addition to the coins and their accompanying notebooks. A typed and privately circulated catalogue by Mervyn Bower, collated shortly after the collection arrived in Tasmania, was helpful in establishing the scope of the collection. Biographical information regarding the Talbots came from a recently published history of that illustrious family by Stephen Talbot. The Talbot de Malahide manuscripts and letters, now in the Bodleian Library, Oxford, were sourced for information on the coin collecting pursuits of family members.

David Rampling, PO Box 114, Yacka, South Australia 5470, Australia
Email: rampling@ozemail.com.au

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INTRODUCTION

A quotation from Neil MacGregor's wonderfully informative book, *A History of the World in 100 Objects*, will serve as an appropriate introduction. He writes: 'A history through things is impossible without poets'.[1] The objects we preserve in our public and private collections have stories to tell. Awaking their muse in ways that connect with people is a task we can all share.

During a brief visit to the Tasmanian Museum and Art Gallery (TMAG) in 2013 I was privileged to examine the eighty Scottish coins that form a very small component of the Talbot collection. My request to see these coins arose from a long standing collecting and research interest in Scottish coins.

The collection of over 3000 ancient, medieval and modern coins was gifted to the TMAG in 1972 by the late, Milo

Fig. 1. Milo George Talbot

Bodleian Libraries, University of Oxford, ms. Talbot c. 60, no. 51

John Reginald Talbot, 7th Baron Talbot of Malahide, a member of an ancient Irish aristocratic family that had established roots in north-eastern Tasmania in the early nineteenth century. A branch of the family still resides there, the Tasmanian estate having taken the name Malahide from the ancestral Irish seat. The coin collection appears to have been formed over at least three generations, its principal collector being the benefactor's father, Milo George Talbot.

Milo George Talbot (1854–1931)

Milo George seems to have been an admirable character. A close friend and colleague wrote, 'there was no one for whom I had a higher admiration ... there is nothing he could not have done, but he never thought of himself, and only of his home and how to make others happy.' [2] During a distinguished Army career he served in India, Afghanistan, Egypt and the Sudan, much of his time employed in surveying. At one time he was Acting Governor-General of the Sudan, 'a country which he had literally drawn on the map of the world'.[3] He was a great sportsman, and enjoyed a reputation as a cricketer.[4]

His numismatic interests began when aged ten and while accompanying his father James on a trip to Rome. Here he acquired his father's taste for Roman antiquities and began collecting Roman coins.[5] The British Museum catalogue refers to him as a 'Collector of Roman and Oriental coins',[6] and two notebooks that accompanied the collection to Tasmania give evidence of his engagement with the hobby. There are pages devoted to cataloguing his acquisitions and others recording current prices of coins that took his interest. He made note of queries about coins for which he sought answers and lists of those coins in his collection that he wished to replace with better specimens. Perhaps the most engaging entry is headed 'For Fanny's Information'. Here are collecting instructions he presumably intended to impart to his sister, Frances, to accompany her on her extensive travels, perhaps in the expectation that she would procure some desirable specimens. While stationed abroad he kept his sister fully informed of his numismatic interests through his many long and news-filled letters. His success or otherwise in obtaining coins was a recurring theme.

Other contributors to the collection

Stephen Talbot believes that the origins of the coin collection may be attributed to Milo George's grandfather, James (1767–1850), who had 'lived on the Continent since the end of the Napoleonic War, mainly in Florence, Siena and Rome'.[7] James had a sister Frances (d. 1850) who, like her subsequent namesake, remained single and travelled extensively. She sought the company and admiration of royal and noble families as well as grand titles. Her mention of Vienna's 'medals and antiquities' [8] in one of her letters suggests an interest in coins. She bequeathed her extensive possessions to Milo George's father, also named James (1805–1883).[9] It is possible that coins may have been included in her legacy. James' contribution to the collection is witnessed by annotations in his son's notebooks, some of the coin tickets, and the occasional numismatic reference in letters from Milo to his father.

The role Milo George's sister Frances (1847–1932) played in the acquisition of coins is not only suggested by the entry in Milo's notebook but by the shared familiarity regarding numismatic topics evidenced in his letters.

Milo George's eldest brother Richard (1846–1921) was married to Emily Boswell (d. 1898), the great grand-daughter of Dr Samuel Johnson's biographer, James Boswell.[10] An ebony cabinet containing James Boswell's papers was shipped from the Boswell family seat at Auchinleck in Scotland to Malahide Castle, where its contents were discovered by Milo George in 1908. These papers were, years later, sold to an American for a great price.[11] The cabinet had, at some time in its Scottish domicile, also held a collection of coins.[12] Whether some of these now reside in Hobart is a pleasant speculation.

The TMAG benefactor, Milo John Talbot (1912–1973), appears to have made some minor additions to the collection, but his main collecting passions were horticultural and philatelic.[13] Many of the plants he collected now thrive in the grounds of Malahide castle. His stamp collection was auctioned in London in 1969, fetching the then enormous sum of just under £54,000.[14] It is unfortunate that his memory is tainted by his reportedly intimidating personality and suspicions that he may have been a Russian spy.[15]

The Scottish component: a select quartet

There is no evidence that the Talbot collectors had any predilection for Scottish coins. They constitute a very small component of the overall collection, and while there are desirable coins within their number, they are generally an unremarkable assemblage of some of the denominations issued during the years that Scotland had her own coinage (c. 1150–1709). While it is possible that Scottish coins may have come to Malahide through Scottish marital ties, it is clear from annotations on the coin tickets that others were purchased at auction in London.

The opportunity for today's collectors to acquire a comprehensive collection of rare coins for personal study is fast becoming the prerogative of very few. How, then, might an interested observer appreciate and enjoy a collection such as that now held by the TMAG? I write as one who sought out access to particular coins of personal interest. This required the applicant's perseverance, and accommodation by museum staff, as coins not currently on display needed to be retrieved. The casual visitor to the Museum's 'Money and Medals' gallery is likely to absorb a general impression from the display, but may also be inspired to pursue a more specific interest.

I put before the reader my own associations and reveries as they relate to four Scottish coins, one each of gold, silver, billon and copper, and each issued under a different monarch, as illustrative of what I have valued in a necessarily brief examination of this component of the Talbot collection. I have appended a title to each coin intending this to be a poetic encapsulation of my response to the piece. The coins are presented in a chronological sequence. The diameters of the coins are noted in brackets beneath the photographs.

Fig. 2. James II groat (25 mm)

Obverse ✠IACOBVS‡DEI‡GRACIA‡REX‡SCOTORVM

Reverse DNS‡PTE | CTOR‡ME | ‡Z‡LIBE | RATO‡ME

✠‡VI LLA EDIN BVRG

James by the Grace of God, King of Scotland.
God is my Defender and my Redeemer (Epitome Ps. 144, v. 2).[17]
Edinburgh mint.

JAMES II (1437–1460) SILVER GROAT Fourth fleur-de-lis issue.[16]

Blobs, Blemishes and Bletchley

I was able to view some of the Talbot coins shortly after their arrival in Hobart in the early 1970s. This groat intrigued me then, as I had a very similar coin in my own collection, both coins displaying what I thought to be an unusual inclusion just to the right of the king's head (delineated by a black arrow head in the accompanying illustration). This 'blob' looked to my imaginative eye to have the form of a pomegranate, a likeness particularly convincing on my own coin. My fascination for this feature led me to seek the opinion of Joan Murray, the then doyenne of numismatists with expertise in Scottish coins, who gave the sober verdict that my 'pomegranate' was most probably a prolongation of the long and undulating curls brought about by worn or damaged dies. In a later letter she graciously expressed the hope that she "wasn't too discouraging about the pomegranate story", and confessed that she liked my speculation that the devout Mary of Guelders, whom James had married in 1449, may have influenced the design of the dies.[18]

In Christian symbolism, the pomegranate alludes to the Church because of the inner unity of countless seeds in the same fruit. The Papal Jubilee of 1450

Fig. 3. Joan Murray examining a coin.
Photograph © David Rampling, 1989

celebrated the unification of the Church following schism, an event important to the Crown and Prelacy.[19] Mary was an active participant in the parliament of that year,[20] and the fleur-de-lis groats were probably manufactured about that time, although confirmatory records no longer exist.[21] Mary is known to have provided bullion to the mint after the death of her husband,[22] suggesting her cognizance of the importance of coinage.

The blotchy green encrustations disfiguring the coin reminded me that James himself suffered a marked disfigurement in the form of a large red birth-mark covering the left-hand side of his face. Rather than being stigmatised by this affliction, he seems to have been personally proud, shrewd and passionate which, coupled with the striking red birthmark, earned him the description of 'James of the fiery face'. His proximity to a 'fiery' explosion of one of his cannons brought his generally admirable reign of eleven years to a premature conclusion.[23]

The ticket accompanying this coin classified it as an issue of James I rather than James II. This assignation to the earlier monarch was the accepted practice up until 1876 when Edward Burns published his re-attribution of these coins,[24] although credit for recognising their connection to James II goes to Henry Christmas, whose observations were included in the sale catalogue of his coins in 1864.[25]

The fourth fleur-de-lis groats are rare. Joan Murray and I identified 28 specimens in private and public collections during our work on them in 1989. Seven obverse and 14 reverse dies produced this small cohort, suggesting a large mintage. The few surviving examples are testimony to the rigor of repeated recalls and melting down of circulating specie.

The preliminary work that we undertook lapsed for want of time on my part, and Joan's death in 1996 brought an end to any further collaboration. It was only on reading a very lengthy obituary some years later that I learnt that I had shared these endeavours with a very significant war-time figure. Joan Clarke, as was her maiden name, was a cryptanalyst and successful code breaker at the famous Hut 8, at Bletchley Park. Her work on the Naval Enigma coding 'helped to shorten the war and saved many lives on both sides of the conflict'.[26] She was a naturally shy and unassuming person. I didn't realise at the time I requested to take the accompanying photograph during a visit in 1989, how much she may have obliged me against her natural inclinations.

Fig. 4. James V ducat (23 mm)

Obverse	XIACOBVS·5·DEI·GRA·R·SCOTOR·1·5·40
Reverse	+HONOR‡REGIS·IVDICIVM·DILIGIT

James 5 by the Grace of God, King of Scotland 1540.
The King's power loveth judgment (Ps. 99, v. 4)[28]

JAMES V (1513–1542) GOLD DUCAT (Bonnet Piece)[27]

Bonnets and Blarney

The ducats of 1539 and 1540 and their fractions, the two-thirds and one third ducats, were the first Scottish coins to bear a date. Dating subsequently became a common practice on many denominations. The gold of the coins of 1540 was said to be sourced from local mines at Crawford Moor and Corehead, although this may not be the only instance of native gold being used in the Scottish coinage. The coin's popular name of 'Bonnet piece' derives from the fashionable adornment covering the king's head, a precedent that was followed on a gold coin of his grandson, James VI, the ostentatious 'Hat piece' of eighty shillings. On this later coin the hat had assumed the then more fashionable form of having a very high crown.

James V appears to have valued his many bonnets. An inventory of 1542 lists thirty-one bonnets, not with his other clothes but with his jewels, as many of them were 'heavily trimmed with gold buttons, gemstones and pearls in gold settings'.[29] Some of these adornments can be seen on the rim of the bonnet portrayed on the coin. It has been remarked that the bonnet imparts a halo effect to the king's visage,[30] perhaps an impression not without intent or message.

The coin has been embedded in memorable fiction courtesy of Sir Walter Scott's novel *The Antiquary*:[31]

> Sir Arthur drew from his pocket a large ram's horn, with a copper cover, containing a considerable quantity of coins ... The Antiquary's eyes glistened as he eagerly spread them out on the table.
>
> 'Upon my word—Scotch, English, and foreign coins, of the fifteenth and sixteenth centuries, and some of them *rari—et rariores—etiam rarissimi!* Here is the bonnet-piece of James V ...'

It is necessary to temper the fiction indulged by Scott if any reader should assume that Bonnet pieces are of the highest rarity. They are certainly rare, but to use a phrase borrowed from a nineteenth century authority, those of 1540 are 'less rare' than those dated 1539.[32] There are, for example, five ducats of James V catalogued in the collections of the Ashmolean and Hunterian Museums, compared with only one fourth variety fleur-de-lis groat of James II.[33, 34]

In Scott's *Tales of a Grandfather*,[35] a legend sustained through the annals of time, is retold as follows:

> It is said, that upon one occasion the King invited the ambassadors of Spain, France, and other foreign countries, to hunt with him in Crawford Moor ... They dined in the castle of Crawford ... The King made some apology for the dinner ... but he assured his guests that the dessert would make them some amends, as he had given directions that it should consist of the finest fruits which the country afforded ... the dessert made its appearance in the shape of a number of covered saucers ... full of gold bonnet pieces, which they were desired to accept as the fruits produced by the mountains of Crawford Moor ...

MARY (1542–1567) BILLON BAWBEE[36]

What's in a name?

The billon bawbees of Mary, continued the general appearance of the denomination as introduced by her father James V. While the Talbot coin has the characteristic drab appearance of most surviving bawbees, some well-preserved specimens retain their original silvered appearance.[37]

This humble denomination has been so immortalised in stories, poems and songs, that it has remained part of the Scots vernacular long after the denomination vanished from the currency. It is, perhaps, the best known of a number of uniquely titled low value Scottish coins in billon and copper that includes placks, nonsunts, hardheads, turners, atchesons, and bodles.

The derivation of the term 'bawbee' is uncertain. A popular view is that the coin is named after Alexander Orrok, Laird of Sillebawby, who was appointed Master of the Mint in Scotland in 1538. The location and rendering of the lands designated 'Sillebawby', is also uncertain. Possible contenders are Silverbarton (previously called Sillie Barton), and another place a few kilometres away, variously spelt on old maps as Silverbabie, Silverbaby or Sillibabe.[38] Earlier spellings include Slebalbe, Selybawbey, Sillebalbe and Selybalbe. It is also easy to see in these names, descriptors of the coin: siller – Scots for silver, sely – Scots for poor or trifling, and 'baby' and its Scots variants – something diminutive.

Another account states that bawbees 'were so called from being coined of very base metal' the name presumably derived from *bas billon*.[39]

Fig. 5. Mary bawbee (21 mm)

Obverse	**+MARIA·D·G·REGINA·SCOTORV**
Reverse	**✠OPPIDVM·EDINBVRGI**

Mary by the Grace of God, Queen of Scotland,
Town of Edinburgh.

Further uncertainty as to the origins of the coin's quaint name stems from inconsistencies over time. A very early reference to 'Babeis' suggests that this was probably the designation in Mary's time.[40] Fines Moryson, writing in 1613, notes:

> ... the Scots have a long time had small brass *coynes*, which they say *of late are taken away*, namely *Babees*, esteemed by them of old for sixpence, whereof two make an English penny.

Belarius, the banished Lord in Shakespeare's *Cymbeline*, while eulogising to his boys of their wild manners of existence, tells them:

> O, this life
> Is nobler than attending for a check;
> Richer than doing nothing for a babe.

The word *babe* in this passage is the babee of the Scots coinage, which Shakespeare introduced in *Cymberline*, as a sly stroke at the Scots coin, which King James had regulated by proclamation ...[41]

The last of the official bawbee denomination to be issued were the copper bawbees of William III during the period 1695–1697. During the nineteenth century, the terms 'plack 'and 'bawbee', seem to have become interchangeable, a confusion possibly fuelled by their linkage in popular parlance to designate 'little money' or 'last penny'. If Sir Walter Scott's fictional accounts of near contemporary life in Scotland can be trusted so far as giving a true impression of the vernacular of his day, then the phrase 'plack and bawbee' was a frequently used

expression, although no longer supported by any contemporary coins of these denominations. It is likely that the odd bawbee of Charles II or William III might have found its way into the church poor box of Scott's day, but the appearance of placks would have been a singular occurrence, their last date of issue having been in the reign of James VI.

JAMES VI (1567–1625) COPPER PENNY

His Majesty's 'pitie and commiseratioun'

Having stated at the outset that the Talbot group of Scottish coins is unremarkable, I shall reserve an exception for the last of this quartet of coins.

The penny of James VI minted in 1597, of which this is an excellent example, was proclaimed unique by John Lindsay in his *A View of the Coinage of Scotland*, published in 1845.[42] Several, mostly indifferent specimens, have appeared since Lindsay's day, but the number is probably no more than a dozen. The Talbot example, despite displaying some verdigris, would be one of the finest known. The coin is not represented in the Ashmolean, Hunterian or British Museums, and the two specimens in the National Museums of Scotland, Edinburgh, are worn. Another better specimen, once in the National collection, mysteriously disappeared sometime before 1949.[43] It is worth recording that this missing coin is not the TMAG specimen!

Fig. 5. James VI penny (17 mm)

Obverse	• IACOBVS • 6 • D • G • R • SCOTORVM
Reverse	• OPPIDVM • EDINBVRGI

James 6 by the Grace of God, King of Scotland, Town of Edinburgh.

While a stated objective of the coinage of twopenny and penny pieces was *'pitie and commiseratioun towardis the puir without respect to ony proffeit'*,[44] the initiative for this new coinage had a less altruistic aim. The mint-master recommended the issue as not only being profitable to the king, but that it would enable the destruction of false and foreign coins then in circulation. The new minting process also ensured uniformity of weight, so as to counter the export of heavier coins with consequent loss to the Crown. It would seem that this expedient coinage left doubts as to the king's concern for his poorer subjects, as an Act of 1623, authorising a further copper coinage, explicitly stated the forgoing of profit to the crown and emphasised the king's pity for the poor '... whose numbers are become so great and their necessities and miseries so extreme as the like was never heard of nor seen within this kingdom ...',[45, 46] It is doubtful whether such apparently engaging identification by government with the plight of a populace was any more convincing then than now!

A new rolling mill technology produced coins with flans of uniform thickness, and module size was regulated with new sharp punches. While thus foreshadowing the milled coinage of the next century in the preparation of the blanks, the coins were still struck by the traditional manual process.

CONCLUDING REFLECTIONS

Other coins in the collection could just as readily serve for discussion as the four I have presented. Those selected have each excited their own associations: the silver groat – a special relationship; the gold ducat – social history and literary diversions; the billon bawbee – the appropriation of coin to vernacular discourse; and the copper penny – a seeming duplicity in governance.

The Talbot collection is a rich resource largely hidden from view. A current exhibition of approximately a hundred assorted coins from the collection, while attractively displayed, frustrates the enquiring observer who will wish to see both sides of the coins.

It has been stated that museum curators would be happy not to have to deal with coins.[47] They are difficult to display, not only on account of having two sides, but their small size and often considerable value, requires some reconciliation between adequate viewing arrangements and security. Coins are also complex artefacts to adequately document, requiring more descriptors than, say, a painting. Their interpretation demands a degree of specialist knowledge now lacking in most institutions having coin collections, as cost saving measures have removed numismatists from curatorial roles. Reconciling these difficulties to the need for public access and study, must be an ongoing priority. Gifted coins and their stories belong as much to visitors as they do to a museum's staff.[48]

The Talbot coins suffered some indelicate handling early in their Tasmanian domicile, with residues of an adhesive used for display purposes still present on many. This is an enduring embarrassment that in all likelihood contributes to a wariness regarding access and limits the collection for appreciation and research purposes. Repair work is highly desirable but, like

Fig. 7. The Talbot collection display in the Coins and Medal Gallery, TMAG.

all initiatives, dependent on priorities and funds.

To date there have been no published studies of any series within the collection. The late Robert Carson, a former Keeper of Coins at the British Museum, examined the Roman coins in the 1980s, but there does not appear to be any published report of his findings.

It is to be hoped that further interested visitors and students will endeavour to bring their own creative approaches to the Talbot collection, and in so doing support its custodians in making the collection more widely known and accessible.

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I wish to thank Roger McNeice for his support of my initial application to view the coins, Bill Bleathman for facilitating the visit, and Elspeth Wishart for attending to all the practicalities that viewing involved. I also wish to acknowledge the staff of the Bodleian Libraries, University of Oxford, for enabling access to the Talbot de Malahide family correspondence, and for permission to reproduce the photograph of Milo George Talbot (MS. Talbot c. 60, no. 51). Stephen Talbot expressed interest in my endeavours and graciously provided information and guidance.

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7 Stephen Talbot, email (8 August 2013).
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12 Turnbull, Gordon (2005) 'Object Lesson: Boswell's Ebony Cabinet' *Yale Alumni Magazine: Arts & Culture* May/June http://archives.yalealumnimagazine.com/issues/2005_05/arts.html
13 In addition to his numismatic gift to the TMAG, Lord Talbot sponsored a six volume publication *The Endemic Flora of Tasmania*. His introductory essay in Volume One, begins: 'I am a born collector. True, I have had collections thrown upon me. My father's coins for instance...'. Milo goes on to describe his own near obsession with philately, but states that his father 'thought coins far more interesting to collect but ... that stamps were a better investment'.
14 Talbot (2012) p. 547.
15 The spying allegation is unproven; the circumstantial evidence is recorded in Talbot (2012), Chapter XXI.
16 The groats of James I and the earliest groats of James II display fleur-de-lis in alternate quarters of the reverse design. Their four classificatory subdivisions derive from other distinguishing features, the fourth variety being the latest bearing fleur-de-lis. The groat at this time was current for sixpence.
17 This motto, or variants of it, adorned Scottish coins from the reign of David II (1329–1371) up until the reign of James IV (1488–1513).
18 Joan Murray, letter (28 August 1989).
19 In MacGregor (2012) there is a chapter devoted to a 4th century mosaic featuring the head of Christ placed between two pomegranates, which MacGregor states may refer to the myth of Persephone 'a great allegory of ... death and rebirth, of descent into hell and return to the light', a resurrection motif appropriate to these contemporary events.
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27 Current for 40 shillings Scots.
28 This motto was first used on a fourteenth century Sicilian coin of Robert of Anjou; in Scotland it was adopted by James V and James VI.
29 Bennett, H. (1983) 'The Scots Bonnet' Ch. 35 in *From the Stone Age to the Forty-Five – Studies Presented to R.B.K. Stevenson*, Edited by Anne O'Connor and D.V. Clarke, John Donald, Edinburgh.

30 ibid. p. 549.
31 Chapter 22, https://ebooks.adelaide.edu.au/s/scott/walter/antiquary/chapter22.html
32 Robertson, J.D. (1878) *A Handbook of the Coinage of Scotland*, George Bell and Sons, London, p. 17.
33 Bateson, J.D. and Mayhew, N.J. (1987) *Sylloge of Coins of the British Isles 35 – Scottish Coins in the Ashmolean Museum, Oxford and the Hunterian Museum, Glasgow*, Oxford University Press and Spink & Son Ltd.
34 During the past decade, gold replicas of the ducats bearing the date 1540, have been offered for sale.
35 Chapter 27, https://ebooks.adelaide.edu.au/s/scott/walter/tales-of-a-grandfather/chapter27.html
36 The coin is made of an alloy of copper and silver, and was current for sixpence.
37 The surviving bawbees of Mary's reign display a remarkable range of hues. While most have a grey drab appearance, I have seen brown, black, green, silver and even purple examples, presumably the influence of oxidation over time in various habitats.
38 Roger Barnes, 'Sillebawbe', *MINTMARK* No. 357 (June 2014), Numismatic Society of Auckland Inc., Auckland.
39 Cochran-Patrick, R.W. (1876), *Records of the Coinage of Scotland*, Edmonston and Douglas, Edinburgh, Vol. I, p. cxxxv.
40 Extracts from the Acts of Parliament of Scotland in: Lindsay, J (1845) *A View of the Coinage of Scotland*, Messrs. Bolster, Cork, p. 239.
41 Chalmers, G (1799) *A Supplemental Apology for the Believers in Shakespeare-Papers*, Egerton, London. pp. 421–422. Chalmers' interpretations drew much contemporary criticism.
42 Lindsay (1845) p. 217.
43 Holmes, N.M.McQ. (2006) *Sylloge of Coins of the British Isles 58 – Scottish Coins in the National Museums of Scotland, Part I 1562–1603*, Oxford University Press and Spink & Son Ltd., Plate 98 (*cont.*)
44 Cochran-Patrick (1876) Vol. I, p. 129.
45 I have rendered the original Scots wording of this extract more accessible to the modern reader. The original wording of the Proclamation can be accessed in: Cochran-Patrick (1876), Vol. I, pp. 241–242.
46 I have drawn on an account of the billon and copper coinages of James VI in: Nicholas Holmes, *Scottish Coins – A history of small change in Scotland*, NMS Publishing Ltd., Edinburgh, 1998, pp. 46–56.
47 Mike Markowitz, 'Why museums hate ancient coins' *COINWEEK*, 23 May 2014. http://www.coinweek.com/opinion/commentary/museums-hate-ancient-coins/
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THE 'ROADSIDE WALLABY-GRASS' *RYTIDOSPERMA POPINENSE* – ENDANGERED OR WEED?

Graeme S. Lorimer

Lorimer, G.S., 2014. The 'Roadside Wallaby-grass' *Rytidosperma popinense* – endangered or weed? *Kanunnah* 7: 54–70. ISSN 1832-536X]. *Rytidosperma popinense* (D.I.Morris) A.M.Humphreys & H.P.Linder has hitherto been regarded as a rare Tasmanian endemic grass with the paradoxical habitat of roadsides, pasture, wasteland and lawns. This study has found live and pressed specimens of *R. fulvum* (Vickery) A.M.Humphreys & H.P.Linder from mainland Australia that match the morphology, ecology and favoured growing conditions of *R. popinense* (including the holotype), well within the expected infraspecific variability of a *Rytidosperma* species. *Rytidosperma popinense* is therefore relegated to synonymy under *R. fulvum*. This changes the status of *R. popinense* from a threatened Tasmanian endemic species to simply an outlier of a species that is common in south-eastern mainland Australia. This has major implications for future effort and expenditure to conserve the species. In addition, circumstantial evidence comes from the species' ecology, distribution, history of detection, and morphological uniformity in Tasmania that it has been introduced to the state. This study is a prime example of the practical importance of taxonomy and specimen collections, with implications worth hundreds of thousands of dollars.

Graeme S. Lorimer, Biosphere Pty Ltd,
13 Kyamba Ct, Bayswater North, Victoria 3153, Australia.
Email: Graeme.Lorimer@biosphere.net.au

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INTRODUCTION

Rytidosperma Steud. is a genus of Danthonioid grasses concentrated in alpine and cool temperate environments of the southern hemisphere, with a few species extending to the tropics at high elevations. Globally, there are seventy-three accepted species of *Rytidosperma* in the World Checklist of Grasses (Clayton *et al.* 2014). All but two of Australia's forty

Fig. 1. *Rytidosperma popinense* plants in flower on a disused driveway in Dynnyrne, Hobart.

accepted species go by the common name of wallaby-grasses. Tasmania stands out globally for its large number of *Rytidosperma* species with a high degree of endemism. The Australian Plant Census lists twenty-three species of *Rytidosperma* for Tasmania, of which six species are not recorded outside Tasmania and one is shared only with New Zealand. One of the species recorded only in Tasmania is *Rytidosperma popinense** (D.I.Morris) A.M.Humphreys & H.P.Linder. A photograph of some plants of this species appears in **Fig. 1**. The species' known habitat comprises roadsides, pasture, wasteland and lawns. It occurs in metro Hobart, Richmond, Ross, Bothwell and along the Midland Highway between Hobart and Melton Mowbray. It goes by the common names 'Roadside Wallaby-grass' and 'Blue Wallaby-grass'.

Until 1995, *R. popinense* was reliably known from only a single, small colony near Kempton, 42 km north-north-west of Hobart. It was consequently listed as 'endangered' under the Tasmanian *Threatened Species Protection Act 1995* and

* The orthographic variant, *Rytidosperma popinensis*, has been used in Australian publications but as *Rytidosperma* is neuter, the correct nominative singular adjectival epithet is *popinense*, as per Clayton *et al.* 2014).

the Commonwealth *Endangered Species Protection Act 1992*. The latter was superseded by the *Environment Protection and Biodiversity Conservation Act 1999*, which retained the listing of *R. popinense* as 'endangered'. The species' known locations and population increased steadily since then, causing the status under the Tasmanian Act to be downgraded from 'endangered' to 'rare' in 2012. This is not, at the time of writing, reflected in the Commonwealth Act.

In 2012, several botanical consultants whose work spans Tasmania and Victoria independently spoke to the author about their difficulty distinguishing *R. popinense* from the Australian mainland species, *R. fulvum* (Vickery) A.M.Humphreys & H.P.Linder. This prompted an investigation into whether *R. popinense* is really just a Tasmanian outpost of a mainland species, and if so, whether it was introduced to Tasmania after European settlement. The implications could be profound because the costs incurred in conserving the species and modifying development proposals are large.

This article first considers whether *R. popinense* is genuinely distinct from *R. fulvum* and then whether has it been introduced to Tasmania.

IS *RYTIDOSPERMA POPINENSE* A DISTINCT SPECIES?

Rytidosperma popinense is a morphologically defined species. This study tests whether it is truly morphologically distinct in regard to reported or previously undetected characters, or ecologically distinct. Morphology has been assessed in seedlings and mature plants.

Morphology at maturity

Rytidosperma popinense is fairly distinctive among Tasmanian *Rytidosperma* species but it has sometimes been confused with forms of *R. indutum* (Vickery) Connor & Edgar and *R. tenuius* (Steud.) A.Hansen & Sunding. In Tasmania, the simplest differentiating feature of *R. indutum* is its fine, inrolled leaves, while for *R. tenuius*, its shorter palea with a firmer, less acute apex. *R. tenuius* is often further differentiated by the presence of moderately dense (but deciduous) tuberculate hairs on younger leaves. Neither *R. indutum* nor *R. tenuius* has the bluish tinge that is usually apparent in *R. popinense*. The density of scattered hairs between the two main rows of hairs on the lemma is usually greater in *R. popinense* (**Fig. 2**) than the other two species but there is some overlap, confounding the identification key in *The Student's Flora of Tasmania* (Morris 1994).

Mistaking *R. tenuius* for *R. popinense* led Gilfedder & Kirkpatrick (1997) to report four erroneous Tasmanian records of *R. popinense* in Campbell Town, Conara and Avoca, later corrected by Kirkpatrick & Gilfedder (1999). The mistaken Avoca record also appears in Morris (1994) and the specimen supporting it (HO 303799) was re-determined in 2002 by Morris as *Austrodanthonia tenuior* (Steud.) H.P.Linder.

Despite occasional identification difficulties, *R. popinense* is nevertheless accepted as distinct from all other Tasmanian *Rytidosperma* species. There is considerably less distinction from the Australian mainland species, *R. fulvum*.

Morris (1990) wrote that *R. popinense* 'differs from *D. linkii* var. *fulva* [=*R. fulvum*] in being generally a smaller plant and

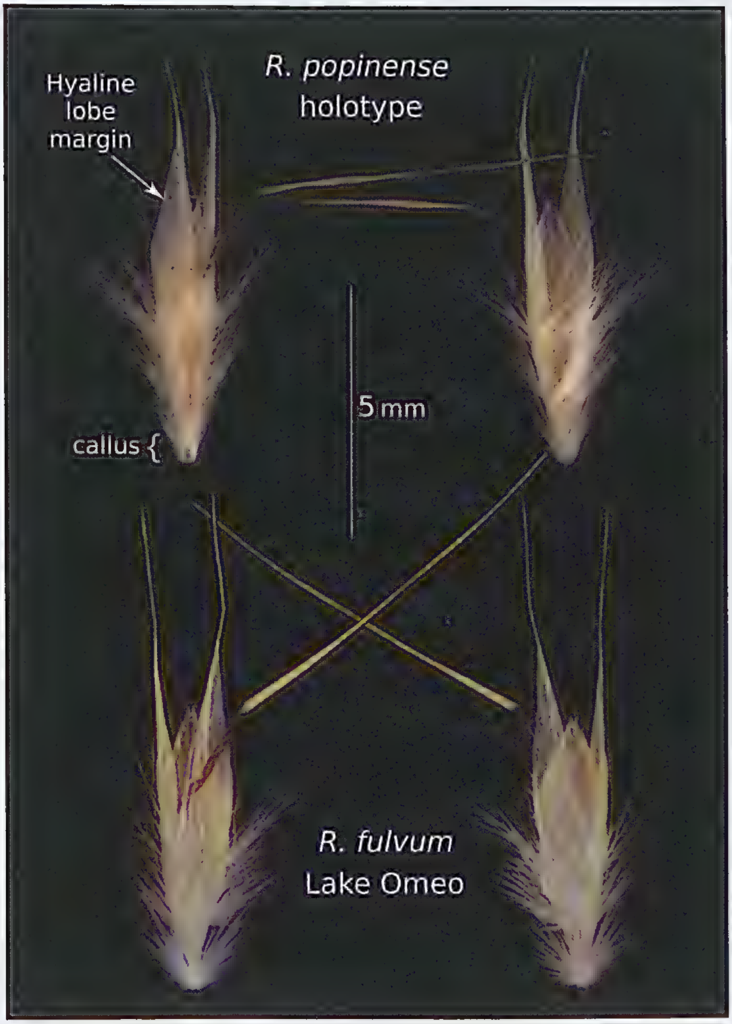

Fig. 2. TOP: A floret of the holotype of *R. popinense* viewed from the lemma side (left) and the palea side (right). BOTTOM: A floret of *R. fulvum* from Lake Omeo, Victoria (*G.S. Lorimer 626*).

in having the hairs on the back of the lemma scattered between a lower row of hair-tufts c. 1mm long and an upper row c. 1 mm long whereas in *D. linkii* var. *fulva* the lower row of hair-tufts is absent and the hairs on the back are evenly scattered, grading into the upper row of hairs which are c. 1 mm long. The inter-carinal area of the palea is glabrous in *D. popinensis* but is hairy in *D. linkii* var. *fulva*'. The lemma features referred to by Morris are illustrated in **Fig. 2**.

Linder's (2005) identification key in the *Flora of Australia* uses a different key distinction: that when the lowest floret from a spikelet is examined, its lemma lobes (excluding bristles) are longer than the lemma body (excluding callus) in *R. fulvum* but equal in *R. popinense*.

The present author considered dozens of additional characters as prospects for differentiating *R. popinense*. This was done partly by comparing the descriptions of *R. popinense* by Morris (1990) and Linder (2005) with the descriptions of *R. fulvum* by the same authors and Vickery (1956). Further distinguishing characters were sought by inspecting every specimen of *R. popinense* in the Tasmanian Herbarium and the National Herbarium of Victoria, and approximately fifty specimens of *R. fulvum*. From this process emerged three potentially distinguishing characters that had not been reported by Morris (1990) or Linder (2005): leaf indumentum, leaf blade width and the width of the hyaline margins of the lemma lobes (labelled on **Fig. 2**). While each of these can be variable within a *Rytidosperma* species, it was thought that in combination, they may support the previously reported discriminating characters. The bluishness that is typically seen in live *R. popinense* plants is useful in the field but it does not persist in pressed specimens.

The full list of characters reported to distinguish *R. popinense* from *R. fulvum*, or that have been added as candidates in this study, appear in the first column of **Table 1**. The second column of Table 1 represents the features that Morris (1990) reported to distinguish *R. popinense* from *R. fulvum*. The third column provides the corresponding data from Linder (2005). The remaining columns contain observations of the two most informative specimens of *R. popinense* analysed for this investigation, namely:

- The holotype of *R. popinense* – Tasmania, 0.5 km N of Kempton, opposite 'Mood Food', Roadside, 25 Apr 1985, *D.I. Morris 8556* (HO 92651); and

- *R. popinense* – cultivated in Melbourne, ex corner of Teatree & Ford Roads, Pontville, Tasmania, Royal Tasmanian Botanical Gardens accession 14377 sown 16 June 2013, this specimen collected 21 Jan 2014, *G.S. Lorimer 2335*;

The author's examination of the holotype of *R. popinense* included 139 characters, mostly recorded from multiple parts of the specimen to capture extremes. The data are stored in a database as part of a taxonomic review of Australian *Rytidosperma*. Morris (1990) was perhaps less intent on capturing the full range of some characters of the holotype, which would explain why he recorded narrower ranges of plant height and leaf blade width, albeit from only a single specimen; similarly Linder (2005), with regard to maximum plant height. In any event, the final column of **Table 1** shows that *R. popinense* can grow much taller than the holotype and have broader leaf blades.

Table 2 provides data for *R. fulvum* for the same characters as Table 1, as obtained from the same two publications and from the two most informative specimens of *R. fulvum* analysed for this investigation, namely:

- *R. fulvum* – Victoria, grassland on terraced banks of Lake Omeo, just west of the old Benambra timber mill, 2 Feb 1993, *G.S. Lorimer 626*; and

Table 1. Character comparisons between two published descriptions of *R. popinense* and this study's observations of two key specimens. Lemma observations are for the lowest floret in a spikelet. For consistency with Linder (2005), the length of a lemma body excludes the callus and the length of a lemma lobe excludes the bristle. The hyaline margins of the lemma lobes are deemed 'narrow' if they occupy substantially less than half the lobe's width, midway along the lobe; and conversely 'broad'.

RYTIDOSPERMA POPINENSE

SOURCE OF INFORMATION	LITERATURE Description by Morris (1990)	LITERATURE Description by Linder (2005)	SPECIMEN Holotype, *D.I. Morris 8556*	SPECIMEN *G.S. Lorimer 2335*, ex Pontville, Tas
Max. plant height (m)	0.45	0.4	0.6	0.87
Leaf blade width (mm)	to 2.0		to 2.8	to 2.8
Leaf indumentum	glabrous		glabrous	glabrous*
Hyaline margins of lemma lobes			broad	broad
Length ratio, lemma lobe: body		1	1.3	1.3
Lower lemma hairs	in a row of tufts	in a row of tufts	in a row of tufts	in a row of tufts
Upper lemma hair length (mm)	4		3	3
Upper lemma hairs	tufted (? and disjunct)	tufted, disjunct	tufted, disjunct	tufted, disjunct
Hairs between palea keels	glabrous		glabrous	glabrous

* While the leaves in the pressed specimen ex Pontville were glabrous, the same plant subsequently produced sparsely pilose new growth like the Milang specimen of *R. fulvum*

- *R. fulvum* – cultivated in Melbourne, ex South Australia, NS road reserve between two grazing paddocks approximately 1 km W of Milang, Adelaide Botanic Gardens accession 172988, sown 1 July 2013, this specimen collected 3 Feb 2014, *G.S. Lorimer 2351*.

The second column of **Table 2**, corresponding to a wild specimen of *R. fulvum* from Lake Omeo in Victoria's eastern highlands, represents a near-perfect match with the data from Table 1 for the holotype of *R. popinense* and the cultivated specimen of *R. popinense* from Pontville. The small differences in plant height and leaf blade width are within the normal variability of a single plant depending on growing conditions, and can certainly be accommodated within a species. In addition to the characters in Tables 1 & 2, all other characters in Morris's description of *R. popinense* were

Table 2. As for Table 1, but for *R. fulvum.*

RYTIDOSPERMA FULVUM

SOURCE OF INFORMATION	SPECIMEN *G.S. Lorimer 626*, Lake Omeo, Vic.	SPECIMEN *G.S. Lorimer 2351*, ex Milang, S.A.	LITERATURE Description by Linder (2005)	LITERATURE Description by Morris (1990)
Max. plant height (m)	1.07	0.66	1.15	may be >0.45
Leaf blade width (mm)	to 3	to 2.5		
Leaf indumentum	glabrous	glabrous to sparsely pilose		
Hyaline margins of lemma lobes	broad	narrow		
Length ratio, lemma lobe: body	1.1	1.3	>1 and <2	
Lower lemma hairs	in a row of tufts	in a row of tufts	in a row of tufts	not in a row
Upper lemma hair length (mm)	3 centrally, 4 at margins	3.5 centrally, 4 at margins		5
Upper lemma hairs	tufted, disjunct	tufted, disjunct	tufted	'evenly scattered, grading into the upper row'
Hairs between palea keels	glabrous	glabrous		hairy

found to match the Lake Omeo specimen of *R. fulvum*, except that the number of florets per spikelet could not be checked in the Lake Omeo specimen as its inflorescences were shedding seed.

The reported distinctions between *R. popinense* and *R. fulvum* are solely morphological. If it is accepted that the holotype of *R. popinense* matches the morphology of any specimen of *R. fulvum*, the basis for recognition of *R. popinense* as a species falls away.

A second opinion was sought from senior botanist N.G. Walsh (who has named two *Rytidosperma* species) on the match between the *R. fulvum* specimen from Lake Omeo and the *R. popinense* specimen from Pontville. On inspection of both specimens, he concurred that they appear conspecific.

The Lake Omeo specimen came from an elevation of 700 m with a climate similar to the region occupied by *R. popinense* in Tasmania. The soil was loam derived from Quaternary deposits, as at some sites of *R. popinense* in Tasmania, e.g. near Melton Mowbray. The Lake Omeo specimen does not appear distinct from *R. popinense* either morphologically or in its associated growing conditions.

The cultivated specimen of *R. fulvum* from Milang, S.A. in the third column

of Table 2 represents another very close match with the *R. popinense* specimens in Table 1. The only differences that could be found between these specimens are that the Milang specimen has narrower hyaline lemma lobe margins and sparse, deciduous hairs on a few young leaves (which are also occasionally seen in *R. popinense* specimens, e.g. HO 327817).

The Milang and Pontville specimens come from potted plants that have been grown side by side under the same conditions. The former is one of a batch of eight and the latter, a batch of ten. Even on close inspection, the author can only tell the batches apart by their labels and (in season) the width of the hyaline margins of the lemma lobes – though the Milang plants tend to be less bluish. While it may seem from Tables 1 and 2 that the Milang plants might be distinguishable by the presence of sparse hairs on some of the leaves, the Pontville plants also have that feature. While the Milang and Pontville plants are almost indistinguishable, another strain of *R. fulvum* growing alongside them is instantly distinguishable by its colour, leaf size, leaf indumentum, inflorescence shape and floret characters. The morphological differences between the Milang and Pontville plants are negligible within the broad variability of *R. fulvum* that was displayed by the fifty or so Australian mainland specimens of *R. fulvum* examined in this study.

The final column of Table 2 represents the properties of *R. fulvum* that Morris (1990) used to distinguish it from *R. popinense*. However, those properties conflict with the three prior columns (as well as with Walsh (1994)), invalidating Morris's conclusion that *R. popinense* is morphologically distinct. At that time, the Tasmanian Herbarium held only a single specimen of *R. fulvum* and it seems likely that Morris had recourse to too few specimens to capture the species' full variability – see the Discussion below.

This variability of *R. fulvum* sometimes causes problems for identification and may one day result in its segregation into separate taxa. The Lake Omeo and Milang specimens were identified as *R. fulvum* by the author and the Lake Omeo specimen was confirmed by N.G. Walsh. Both specimens conform in all respects to the descriptions of this taxon by Walsh (1994) and Linder (2005) and they are not completely consistent with the descriptions of any other species in those publications. Indeed, Linder's description of *R. fulvum* is usually consistent with specimens that have previously been identified as *R. popinense*, with basal florets that have lemma lobes longer than the lemma bodies (rather than equal, in the description of *R. popinense*). Note that Linder takes the lemma body to exclude the callus and the lobe to exclude its terminal bristle.

Seedling morphology and life history

The morphological analysis above appears to provide adequate demonstration that *R. popinense* is not distinct from the currently accepted concept of *R. fulvum*, but to be thorough, seedling morphology and life history were also checked. This was done using the cultivated plants discussed above, grown under the same conditions in suburban Melbourne.

Ten *R. popinense* seeds from Pontville, Tasmania, were sown into a punnet on 16 June 2013, then ten seeds of *R. fulvum* from Milang, South Australia were sown into another punnet two weeks later. Eight of the Milang seeds and all ten Pontville seeds germinated, the former taking nine days and the latter eleven. Seedlings were inspected most days and examined in detail, both macroscopically and microscopically, at roughly weekly intervals over the following month. To illustrate the nature of the observations, the following is a representative record:

> Primary leaves 40×1¼ mm, flat, erect except slightly incurved longitudinally in the distal half; Secondary leaves of equal length to the primary and divergent from them by c. 10°. Third leaves exserted 1–10 mm from the subtending sheaths.

The seedlings were pricked out and removed from their greenhouse on day 41 (Pontville) and day 34 (Milang). Detailed observations continued to be taken, but less frequently, to maturity and beyond.

The two batches of seedlings were observed to closely follow each other's development, the main differences being that the Milang seedlings were slightly more slender and upright and slower to produce new shoots. By 2 November 2013, the only distinctions among numerous characters that were examined were those just mentioned and the appearance of sparse, very fine, deciduous hairs on new growth of the Milang plants (later seen also on the Pontville plants). No more distinctions between the batches emerged subsequently and the slight difference in habit vanished.

Four plants of the Pontville batch flowered in December 2013 and one Milang plant flowered in January 2014. All five of these plants shed seed in January and February 2014.

The author is currently growing over fifty batches of *Rytidosperma* spanning approximately thirty-five taxa. Within this context, the observed morphological and developmental differences between the Pontville and Milang seedlings seem very minor, even for different provenances of a single *Rytidosperma* species.

TAXONOMY

Since morphology is the only reported basis for recognising *R. popinense* as distinct , and this study demonstrates that it is not truly morphologically distinct, either at maturity or as a seedling, the only logical conclusion is to treat *R. popinense* a synonym of *R. fulvum*.

Rytidosperma fulvum (Vickery) A.M.Humphreys & H.P.Linder, *Ann. Missouri Bot. Gard.* 97: 358 (2010); ***Austrodanthonia fulva*** (Vickery) H.P.Linder, *Telopea* 7: 271 (1997); *Danthonia linkii* var. *fulva* Vickery, *Contr. New South Wales Natl Herb.* 1: 299 (1950).

TYPE: New South Wales, Flemington, 31.3.1929, *G.B. Vickery s.n.* (holo: NSW no. 1573).

Rytidosperma popinense (D.I.Morris) A.M.Humphreys & H.P.Linder, *Annals of the Missouri Botanical Garden* 97(3): 359–360 (2010); *Austrodanthonia popinensis* (D.I.Morris) H.P.Linder, *Telopea* 7(3): 273 (1997); *Notodanthonia popinensis* (D.I.Morris)

H.P.Linder, *Telopea* 6(4): 616 (1996); *Danthonia popinensis* D.I.Morris, *Muelleria* 7(2): 157; fig. 8b, 9 (1990). Syn. nov.

TYPE: Tasmania, 0.5 km N of Kempton, opposite 'Mood Food', Roadside, 25 Apr. 1985, *D.I.Morris 8556* (holo: HO 92651; iso: HO, AD, NSW).

Is *Rytidosperma popinense* / *fulvum* indigenous to Tasmania?

If *R. popinense* is not distinct from *R. fulvum* (and therefore not endemic to Tasmania), the question arises whether it is indigenous to Tasmania or has been introduced since European settlement. This question relates directly to the effort that should be taken to conserve it in Tasmania, or even whether it should be controlled as a weed. No *Rytidosperma* species has hitherto been regarded as introduced to Tasmania but nine Australian species have naturalised in New Zealand (Edgar & Connor 2000), two in Hawaii (USDA 2014), four in mainland USA (*ibid.*) and one on the Portuguese island of Madeira (specimen K000715007 at the Royal Botanic Gardens, Kew). Many *Rytidosperma* species are primary colonisers of bare ground and produce copious seeds that are readily dispersed by humans, animals, in hay and by vehicles. As an example, *Rytidosperma racemosum* (R.Br.) Connor & Edgar is so well adapted to human activity that there are perhaps more plants of it in lawns and nature strips (where it is often abundant) than in its natural habitats.

The possibility of *R. fulvum* being introduced to Tasmania is therefore not surprising. The species' uniformity, ecology, distribution and history of detection in Tasmania provide circumstantial evidence.

ECOLOGY AND DISTRIBUTION

This study sought information about the ecology of *R. popinense* by inspecting previously reported sub-populations in south-eastern Tasmania at Bothwell, Dynnyrne, the Queen's Domain, Richmond, Mangalore, Bagdad and between Kempton and Melton Mowbray. The inspections occurred in December 2013 and January 2014. Specimens were taken as well as notes about reproductive state, population size, associated species, soil profile, land use and evidence of land management activities.

The fieldwork also involved searching areas near the abovementioned locations, particularly in natural or semi-natural vegetation to better determine the species' natural habitat. The observations that were made confirmed the comment in the Threatened Species Listing Statement for *R. popinense* (TSS 2010) that the species tends to be associated with disturbed, open sites rather than native vegetation, mostly on road verges. Most of those sites can be confidently characterised as having been excavated, graded or repeatedly ploughed, where the natural vegetation has at some stage been destroyed and the soil profile changed. *R. popinense* has colonised the barren ground, becoming part of an artificial plant community that contains few indigenous species and is usually dominated by plants of European origin (see Gilfedder & Kirkpatrick (1997) for examples). These observations are consistent with *R. fulvum* in mainland Australia, where the densest occurrences are often on roadside batters close to scattered plants in natural vegetation.

The sites recorded for *R. popinense* span a diverse range of surface geology, mapped by the online 'Land Information System Tasmania' (LIST) as Jurassic Dolerite (e.g. Queen's Domain), Triassic freshwater deposits of sandstone (e.g. Kempton), Tertiary mudstone to sandstone (e.g. Mangalore), Tertiary basalt (Brighton, Pontville) and Quaternary alluvium (widespread). The soils range from sand to clay and may be stony (e.g. Dynnyrne) or not. Sites range from floodplains (e.g. beside Bagdad Rivulet) to steep, dry, north-facing slopes (Dynnyrne). The inferred pre-European vegetation communities are as variable as the physical conditions suggest. *R. popinense* is evidently not at all fussy about its growing conditions.

The broad ecological amplitude of *R. popinense* in Tasmania and its demonstrated ability to persist at sites that have been heavily modified since European settlement are hard to reconcile with the species' apparent rarity, unless it has been introduced and spread with human assistance. It is also hard to understand how an indigenous species with such broad tolerance of growing conditions could have the known spatial distribution shown in **Fig. 3**, without any botanical surveys detecting it further from roads.

By definition, if *R. popinense* is indigenous to its current sites, it was present in pristine vegetation at the same sites prior to settlement. One might therefore expect it to be present in natural or semi-natural vegetation occurring within or abutting the known sites, even if confined to occasional plants in suitable niches such as where an animal has broken ground.

A site centred on Oberon Court in peri-urban Dynnyrne is one of very few that have natural or semi-natural vegetation associated with *R. popinense*. There, an inspection in December 2013 detected a few *R. popinense* around the car park of Christ College, approximately fifty plants on an unpaved driveway of an abandoned construction site (seen in **Fig. 1**) and a few plants among dense weeds and construction waste opposite the driveway. The driveway has been constructed through native vegetation dominated by *Eucalyptus pulchella, Acacia mearnsii, Allocasuarina verticillata, Exocarpos cupressiformis, Bursaria spinosa,* the introduced *Chrysanthemoides monilifera, Rytidosperma caespitosum* and *Themeda triandra*. An extensive, more natural stand of the same natural vegetation community lies 60 m away.

Tellingly, *R. popinense* was spread over the whole driveway but did not extend at all into the abutting unexcavated and uncompacted ground. Two hours of searching in the nearby forest also failed to find any *R. popinense*. The spreading of seed-laden gravel from off site could explain the distribution of *R. popinense* plants within this site and some other sites.

The strong association of this Dynnyrne subpopulation of *R. popinense* with human activity and the absence of any detection in adjacent natural vegetation are much more consistent with an introduced species than a natural occurrence.

The other sites inspected during this study had rather less natural vegetation adjacent to the (quite unnatural) areas occupied by *R. popinense*. However, in each case, *R. popinense* was growing on substrates that were more disturbed

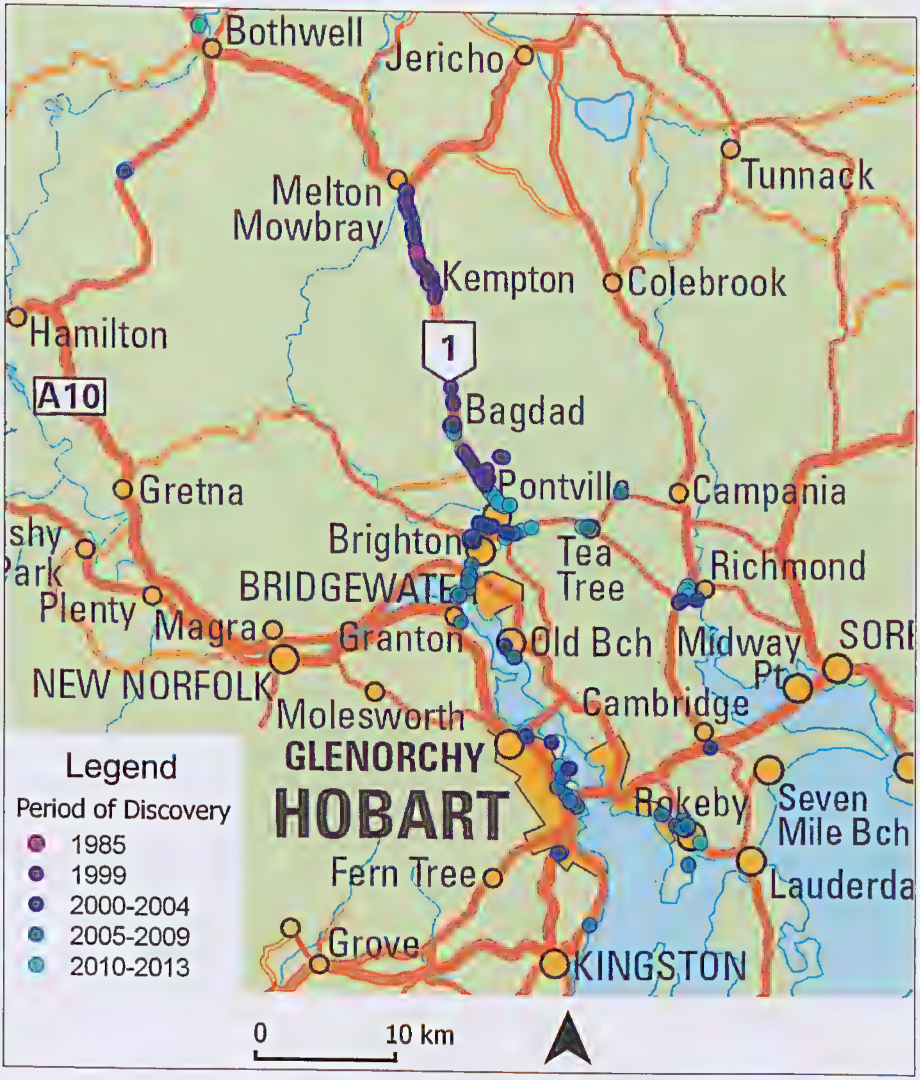

Fig. 3. Map of the location and period of each discovery of a colony of *R. popinense* except the outlier colony at Ross (discovered in 1995), which is 37 km north of the area shown in this map.
BASE IMAGE BY TASMAP (WWW.TASMAP.TAS.GOV.AU) AND SITE LOCATIONS FROM *THE NATURAL VALUES ATLAS*, BOTH © STATE OF TASMANIA

than some adjacent ground; e.g. on a roadside batter and drain at the type locality near Kempton rather than at natural soil level next to the batter, where a few indigenous herbs and *Pimelea humilis* persist.

HISTORY OF DETECTION

Using data from the Tasmanian government's Natural Values Atlas, **Fig. 3** maps all known colonies of *R. popinense* except an outlier at Ross. Each site is colour-coded according to time of discovery.

For ten years following Morris's original discovery of *R. popinense* in 1985, the species was only reliably known to occur in a single colony on the weedy road verge opposite the 'Mood Food' roadhouse and truck stop on the Midland Highway near Kempton. The outlier colony at Ross was discovered in 1995. In 1999, a survey of the Midland Highway road corridor found the species scattered liberally along the highway from Pontville to Melton Mowbray.

Approximately five separate colonies have been found within one kilometre of the type locality, so it is surprising that none of them were found by Morris during 1985–1994 while he was researching and collecting grasses for Part 4B of *The Student's Flora of Tasmania*. One would also have expected more than just the type locality to have been detected during investigations in support of listing the species as endangered under Tasmanian and Commonwealth law prior to 1995. A simple explanation is that the species was highly localised until at least 1994.

North (1994, 1995, 1996) conducted botanical surveys along the Midland Highway corridor in the vicinity of Bagdad and between Pontville and Mangalore, failing to find any *R. popinense*. He was clearly familiar with the species in that period because he discovered the Ross colony in 1995. During a botanical survey in 1999, he found *R. popinense* at six locations where he had been unable to find it in the previous surveys (North & Brereton 2000).

All the preceding cases of *R. popinense* being discovered at sites where it was not found prior are consistent with the hypothesis of the species spreading from a point of introduction. An alternative hypothesis might be that the species went unnoticed in the earlier surveys because it was harder to detect, for reasons that are not apparent.

Of these two alternative hypotheses, the former gains circumstantial evidence from the history of detection of *R. popinense* in the Queen's Domain in Hobart. Seven colonies of the species have been discovered in the Queen's Domain since 2007, all but one of them beside roads. The Domain has been a focus of botanical investigation for over a century. Prior to 2007, sixteen herbarium specimens of *Rytidosperma* were collected there, going back as far as 1894 and including collections by such eminent botanists as L.R. Rodway, R.A. Black and W.M. Curtis. Kirkpatrick (1986) also spent ten years monitoring vegetation in the Queen's Domain. *R. popinense* usually stands out to a botanist and if *R. popinense* was indigenous to the Queen's Domain, it is surprising that no-one detected it until 2007.

The absence of any records of *R. popinense* in the Queen's Domain until 2007 provides further circumstantial evidence of the capacity of *R. popinense* to colonise an area where it is not indigenous. **Fig. 3** suggests that the Queens Domain colonies have probably established as part of a southward spread along the Midland and Brooker Highways.

Roadside slashers moving through existing colonies of *R. popinense* would inevitably transport seeds along roads and between their contracted sites. The species' fecundity, its broad tolerance of growing conditions and its capacity to colonise disturbed ground increase the likelihood that new colonies will establish from transported seeds. Such dispersal is consistent with the initial detection of *R. popinense* opposite a roadhouse and truck stop, followed by detections progressively further along highways leading from the site of discovery. One might expect radiation from the colony beside the Midland Highway in Ross.

Morphological uniformity

Approximately thirty mainland specimens of *R. fulvum* in the National Herbarium of Victoria were examined in this study as well as twenty-four in the author's collection. These specimens displayed wide variability in morphology and some intergradation with *R. bipartitum* (Link) A.M.Humphreys & H.P.Linder, consistent with the observations of Vickery (1956). Vickery also commented more generally that the taxonomy of wallaby-grasses suggests 'a state of evolutionary instability, in which speciation may still be in progress and by no means complete'.

By contrast, this study detected remarkably little variation among the wild, cultivated and pressed specimens of *R. popinense* from Tasmania, other than related to stage of growth or stunting from mowing. This uniformity suggests that the common ancestor of all *R. fulvum* (or *R. popinense*) in Tasmania was probably rather recent in an evolutionary time scale, consistent with introduction since European settlement.

If so, phylogenetic analysis of *R. fulvum* specimens may one day establish the location of origin and the time of introduction to Tasmania. The most recent and thorough genetic analysis of *Rytidosperma* species was that of Linder *et al.* (2010), but the techniques available were unable to resolve relationships down to the level of species.

DISCUSSION

When critically examined against the currently accepted concept of (and variation within) *R. fulvum*, it is illogical to continue treating *R. popinense* as a distinct morphospecies. This study has found that those morphological characters previously employed to distinguish this species are not in themselves sufficient to do so and, among dozens of additional characters examined, none could be found that can reliably separate *R. popinense* from *R. fulvum*. Relegating *R. popinense* to synonymy under *R. fulvum* means it can no longer be considered endemic to Tasmania. The evidence for *R. fulvum* being introduced to Tasmania since European settlement is broad but circumstantial. A scenario of recent introduction of *R. fulvum* to Tasmania, followed by subsequent spread along roads, provides the simplest, most coherent and most likely explanation of the Roadside Wallaby-grass's Tasmanian morphology, uniformity, distribution and history of detection.

Regardless of whether or not the Roadside Wallaby-grass is regarded as introduced to Tasmania, as it is

conspecific with *R. fulvum* (a common species, nationally), it no longer deserves recognition under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (or 'EPBC Act'). This would bring about considerable savings in botanical assessments, referrals to government, protective measures on site, salvage of plants and seeds, purchase and establishment of 'offset' sites, maintenance, monitoring and reporting. As an example, in the past five years, the presence of the Roadside Wallaby-grass in two major road projects has resulted in combined initial costs of roughly $200,000 and ongoing costs averaging approximately $20,000 per year for twenty years. Residential developments and irrigation projects have also been incurring substantial costs. In addition, the Commonwealth and Tasmanian governments incur costs in administering and implementing the EPBC Act. This study's findings mean that these expenses can be redirected to species in greater need.

If the conclusion that *R. popinense* is not distinct from *R. fulvum* becomes generally accepted by botanists, all records of the former species should be reclassified to the latter (being the prior name). There is a separate legal question about whether such a reclassification means that those changed records would no longer trigger the EPBC Act. If plants continue to trigger the EPBC Act on the basis of matching the description of *R. popinense*, some mainland occurrences of *R. fulvum* would be included and development proposals across the vast range of *R. fulvum* will be affected unjustifiably.

This situation will not arise if a current application to delist *R. popinense* under the EPBC Act is successful.

Leaving aside legal interpretations (which are beyond the scope of this study), if this study's conclusions are accepted, there will be no justification for continuing to protect, salvage, propagate or conserve *R. fulvum* in Tasmania. If these activities cease, it seems unlikely that the species would risk extinction in Tasmania in the foreseeable future.

To treat *R. fulvum* as a weed and actively control it would require a higher level of certainty that the species has been introduced to Tasmania. There appears to be no need for control, since the species has shown no sign of escaping weedy vegetation to displace indigenous flora or fauna. Given the small possibility that Tasmanian populations of *R. fulvum* instead represent a remnant native disjunct population, monitoring the population would be more appropriate.

If any doubts linger about *R. popinense* being conspecific with *R. fulvum*, the appropriate courses of action are:

- Further independent scrutiny of the morphological similarity of the specimens cited here;
- Seeking additional specimens of *R. fulvum* from mainland Australia that match the Tasmanian plants; and
- Genetic testing.

THE IMPORTANCE OF HERBARIUM COLLECTIONS

This study highlights the practical importance that taxonomy and herbarium specimens can have, with implications worth hundreds of thousands of dollars. The specimen collections of the National Herbarium of Victoria and the author were critical to revealing that *R. popinense* is conspecific with *R. fulvum*. If a similarly broad collection of *R. fulvum* specimens had been available to Morris (1990) at the Tasmanian Herbarium, the history of the Roadside Wallaby-grass would have been very different. Science, biodiversity conservation and the public interest are all served by a herbarium collection with good representation of specimens from its own jurisdiction and beyond.

SUMMARY

The key finding from this study is that the holotype of *Rytidosperma popinense* (D.I.Morris) A.M.Humphreys & H.P.Linder matches the morphology of certain specimens of *R. fulvum* (Vickery) A.M.Humphreys & H.P.Linder, relegating *R. popinense* to synonymy and eliminating its status as a Tasmanian endemic species. The conclusion takes into account characters in addition to those that have been reported to differentiate the two species. This finding is supported by comparison of cultivated plants at all stages from germination to maturity.

Circumstantial evidence from the species' Tasmanian distribution, history of detection and morphological uniformity indicates a high likelihood that the species has been introduced to Tasmania during the twentieth century.

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A REVISION OF *FISSIDENS* HEDW. IN AUSTRALIA. *F. DEALBATUS* AND *F. HYALINUS*

R.D. Seppelt

Seppelt, R.D. 2014. A revision of *Fissidens* Hedw. in Australia. *F. dealbatus* and *F. hyalinus*. *Kanunnah* 7: 71–77. Three species of *Fissidens* Hedw. (Bryopsida: Fissidentaceae) effectively lacking a leaf costa have been previously recognised as occurring in Australia: *F. dealbatus*, *F. nymanii* and *F. splachnoides*. *Fissidens nymanii* is a synonym of *F. hyalinus* and *F. splachnoides* is here formally synonymized in *F. dealbatus*. In *F. hyalinus*, sections of the limbidium reveal cells that are thinner-walled than in *F. dealbatus* and the limbidium is 1(–2) cells wide and 1(–2) cells thick. In *F. dealbatus*, the limbidium is composed of cells that are very thick-walled with a very narrow lumen, 1–2(–3) cells in width and 1–4(–5) cells in thickness.

R.D. Seppelt, Tasmanian Herbarium,
PO Box 5058, UTAS LPO, Sandy Bay, Tasmania 7005.

KEY WORDS: Fissidentaceae; *Fissidens*; subgenus *Aneuron*; *Fissidens dealbatus*; *Fissidens hyalinus*

INTRODUCTION

The moss family Fissidentaceae has been previously divided into a number of segregate genera, but it is now usual to treat all in a single genus, *Fissidens* Hedw., that has been variously divided into subgenera and sections. Around 900 species names are listed in *Index Muscorum*, with more than 450 species currently accepted (Crosby *et al.*, 2000), together having an almost world-wide distribution, except for high Arctic and Antarctic regions. The greatest species diversity is found in tropical and subtropical regions.

In recent decades there have been significant taxonomic changes at the subgeneric level and also species synonymy in *Fissidens*. The present manuscript forms part of a major revision and updating of the unpublished manuscript treatment of *Fissidens* prepared by the late Ilma Stone and David Catcheside for the Flora of Australia. More than 70 species and infra-specific taxa of *Fissidens* are currently recognised from the mainland States and Territories of Australia. Many are restricted to coastal Queensland which has historically been a primary focus for collectors. Plants

can be erect or ±prostrate, scattered or gregarious, occasionally forming dense turfs or cushions, terrestrial, rupestral, epiphytic, on soil, rock or bark, or occasionally aquatic. Some species are important colonisers of bare soil, particularly roadside banks and even termite mounds.

SYSTEMATIC TREATMENT

Stone (1985b) recognised three species in the former subgenus *Aneuron* in Australia: *F. dealbatus* Hook.f. & Wilson, *F. nymanii* Hook. & Wilson and *F. splachnoides* Broth. Iwatsuki & Haji Mohamed (1987) reduced *F. nymanii* to synonymy of *F. hyalinus*. Without formal status, Willis (1955) suggested possible synonymy of *F. splachnoides* with *F. dealbatus*, the formal proposal for synonymy being made here. The taxa are very similar morphologically with the only consistent diagnostic difference seemingly being the anatomical structure of the limbidium. It is likely that further study may result in additional synonymy within the group worldwide. The species may be separated as follows:

1 Limbidium (1–)2(–3) cells wide, in 2–5 layers, cells narrow-elongate, very thick-walled in section, the lumen very narrow .... ***F. dealbatus***

1' Limbidium 1(–2) cells wide in a single layer, cells elongate, walls not much thickened, in section with a conspicuous lumen .... ***F. hyalinus***

Fissidens dealbatus Hook.f. & Wilson *Fl. Nov.-Zel.* 2: 63. 84 f. 2. 1854.

TYPE: New Zealand, Bay of Islands, J.D.Hooker W.318. Holotype: BM.

SYNONYMY: *Fissidens splachnoides* Broth., Oefvers. Förh. Finska Vetensk.-Soc. 35: 37, (1893) Type: Australia: Qld: Brisbane, *F.M.Bailey 256*. Isotype: NY 01025936. *syn. nov. Conomitrium splachnoides* (Broth.) Müll.Hal., *Gen. Musc. Frond.* 74 (1900). *Conomitrium amplirete* Müll.Hal., *Gen. Musc. Frond.* 73, (1901); *Fissidens ampliretis* (Müll. Hal.) Broth., *Nat. Pfl.* 1(3): 353, (1901). Type: Australia: N.S.W., Balls Head Bay, North Shore of Sydney, *T. Whitelegge*, Sept. 1884. Holotype: H-Br. Isotype: NSW.

ILLUSTRATIONS: I.G.Stone, *J. Bryol.* 14: 321, fig. 2 (as *F. splachnoides*), 322, fig. 3 (1985); J.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key* 28 (2002); D.Meagher & B.Fuhrer, *A Field Guide to the Mosses and Allied Plants of Southern Australia* 39 (2003). (**Fig. 1**)

Plants 4–8 mm long, pale grey-green to dark green, delicate. Loosely gregarious or scattered.. **Stems** simple, pale, fleshy, with basal rhizoids only; in section, all cells thin-walled, outer layers not differentiated; lacking a central strand. Leaves in 2–8 pairs, upper leaves much larger than lower leaves, not overlapping in mid-stem, ±falcate when moist, erect-spreading, loosely crisped when dry; lanceolate to ovate-lanceolate, 1.5–2.5 mm long, 0.4–0.6 mm wide; apex acute; laminae unistratose, limbate; **limbidium** (1–)2(–3) cells wide, 1–4(–5) cells thick, the cells very narrow, elongate, thick-

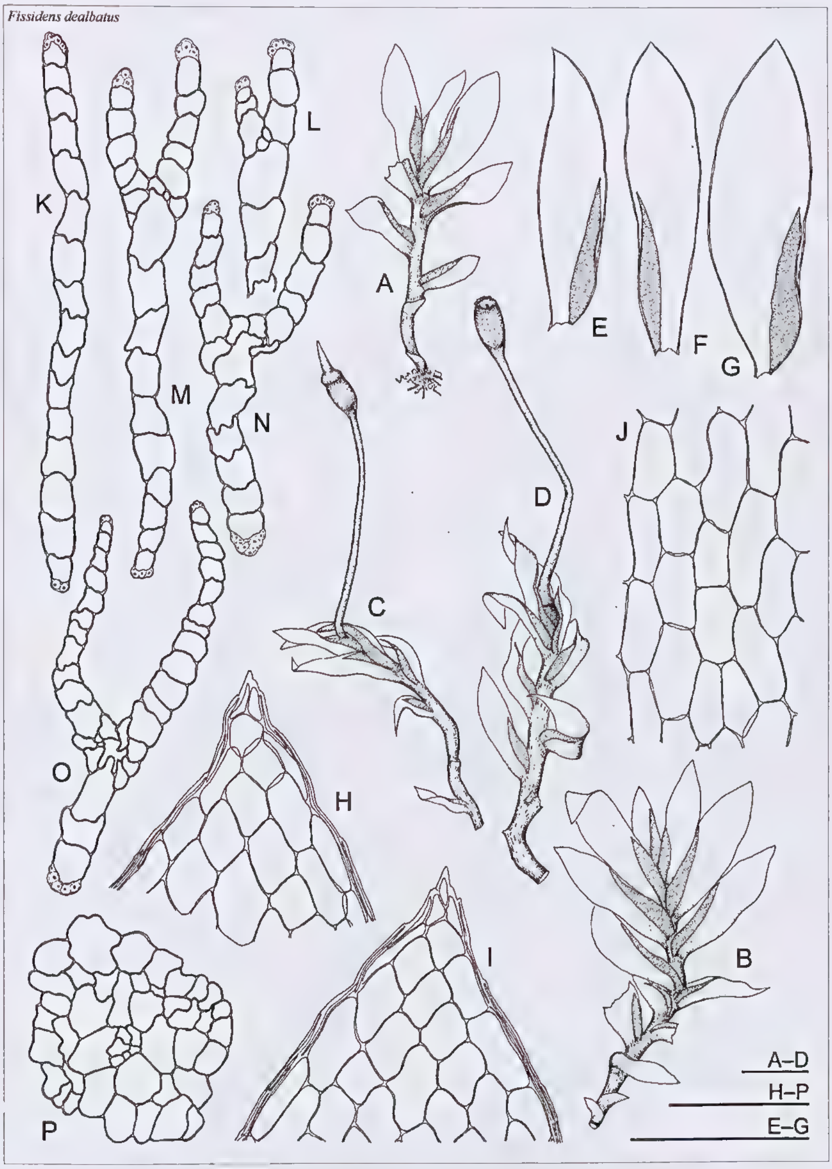

Fig. 1. ***Fissidens dealbatus*** Hook.f. & Wilson in Hook.f.
Drawn from *I.G.Stone 9974*, Victoria, Gippsland Plain (MEL 2194807).

A, B. Sterile plants; **C, D.** Fertile plants; **E–G.** Stem leaves; **H, I.** Cells of leaf apex; **J.** Mid-lamina cells; **K.** Section of apical lamina of leaf; **L–O.** Sections of leaves showing vaginant laminae, dorsal lamina, limbidia and cellular proliferation of junction of laminae; **P.** Stem section.

Scales: = 1.0 mm (A-D); = 1.0 mm (E-G); = 100 μm (H-P).

walled, forming a well-defined border on all laminae; **vaginant lamina** $^1/_2$–$^2/_3$ leaf length, almost closed to closed, **apex** acute; **margins** entire, occasionally weakly crenulate or weakly dentate near leaf apex; **laminal cells** irregularly hexagonal, lax, thin-walled, (30–)40–80(–90) µm long, 20–30(–45) µm wide; **costa** absent but junction of laminae several cells thick in section.

Autoicous or **dioicous**. **Perigonia** terminal on male branches at base of female plants or on separate male plants smaller than female; leaves in 4–7 pairs. **Perichaetia** terminal; **perichaetial leaves** not differentiated from vegetative leaves. **Setae** colourless to pale yellow, 1.5–5.0 mm long, fleshy, ±fragile. **Capsules** erect, symmetric, 0.5–0.8 mm long, 0.3–0.6 mm wide; **exothecial cells** 20–40 µm long, 10–13 µm wide, in *c.* 50–60 columns around the periphery, thin-walled, collenchymatous; **operculum** rostellate to rostrate, 0.2–0.5 mm long; **peristome** of *Scariosus*-type, 30–55 µm wide at base, *c.* 150 µm long. **Calyptra** 0.2–0.5 mm long, narrow conical, covering the capsule, mitriform, flared at base. **Spores** 10–13(–17) µm in diameter, greenish, very finely papillose.

Occurs in W.A., Vic. and Tas.

Grows on soil, usually in wet fern gullies.

Also known from New Caledonia, Vanuatu, Fiji, Samoa and New Zealand.

SELECTED SPECIMENS EXAMINED: W.A.: 30 km from Port Gregory on Yeringa Springs road, *E.B.Best 2884* (PERTH; sterile). Vic.: Otway Range, *M.Davis* (MEL 56883); Cement Creek, Warburton, *I.G.Stone 487* (MEL); Tarra Valley, South Gippsland, *I.G.Stone 9974* (MEL). Tas.: Stackhouse Falls, *W.Archer* (NY); West End Rivulet, *W.Archer* (HO 69009 – fertile) Upper Browns River, *A.V.Ratkowsky H.210* (CANB, HO).

Stone (1985b) recognised three ecostate taxa from the former subgenus *Aneuron* which she considered as distinct: *F. splachnoides* from NSW and southern Qld; *F. nymanii* from India, South-East Asia and tropical north Queensland; *F. dealbatus* from Victoria, Tasmania, New Zealand, Fiji and New Caledonia. *Fissidens splachnoides* was first reported from Australia from a collection made by F.M.Bailey near Brisbane (Brotherus 1893). Without any formal proposal Willis (1955) regarded the species as probably synonymous with *F. dealbatus*, a conclusion with which I agree. The formal proposal for synonymy is thus made here.

Sexuality can be difficult to accurately confirm and in many collections the plants are either sterile or lack sporophytes. While commonly appearing dioicous, in an early collection of *F. dealbatus* from Tasmania ('West End Rivulet', *W. Archer*, HO 69009), the plants are autoicous. A careful dissection of a single plant revealed the presence of two dehisced antheridia amongst about 10 archegonia in a single perichaetium.

Fissidens nymanii was first identified for Australia by Stone (1985a) and collected from Tully Falls, near Ravenshoe, Queensland. Eddy (1988) suggested that *F. nymanii* was "closely related (possibly conspecific) with *F. hyalinus* of more temperate regions." Iwatsuki and Haji Mohamed (1987) reduced *F. nymanii* to synonymy of *F. hyalinus* Hook. & Wilson, a species originally described from eastern North America. Pursell (pers.

comm. 02 Aug. 2013) indicated that, while he had seen no specimens, it was possible that *F. dealbatus* may be close to *F. hyalinus*. While there is considerable overlap in morphological parameters, in the absence of sporophytes *F. hyalinus* (including *F. nymanii*) is distinguished from *F. dealbatus* by its narrower and uni-, occasionally bi-stratose limbidium. The limbidium of *F. dealbatus* is also narrow but when viewed with a microscope it is clearly more than 1 or 2 cells thick and the very thick walls give the cells the appearance of a cluster of pearls, particularly in sections of the leaves.

Fissidens hyalinus **Hook. & Wilson in Hooker's *J. Bot. Kew Gard. Misc.* 3: 89, f.2. 1840**

TYPE: U.S.A., Ohio, Bank Lick, on Cassidy's Farm, near Cincinnati. Isotype: NY.

SYNONYM: *Fissidens nymanii* M. Fleisch., *Musci Fl. Buitenzorg* 1: 19. 1902. *fide* Iwatsuki & Haji Mohamed, *J. Hattori Bot. Lab.* 62: 341, 1987. Type: Java; Tjibodas an sehr Feuchten Stellen an den Boschunger kleiner Wasserlaufe, 1400 m, Mar. 1899, *E. Nyman*. Holotype: FH.

ILLUSTRATIONS: Z.Iwatsuki & T.Suzuki (1982) *J. Hattori Bot. Lab.* 51: 447, Pl. I, figs. 1–18; 448, Pl. II, figs.1–13; A.J.Sharp, H.Crum & P.M.Eckel (1994) *The Moss Flora of Mexico* I. 80, Fig. 58 a–d; R.A.Pursell (2007) Fissidentaceae. *Flora Neotropica Monograph* 101: 251, Fig. 140 G,H. (**Fig. 2**)

Plants pale green, soft, to 5 mm tall. **Stems** unbranched, with basal rhizoids only; in section, all cells thin-walled, outer layers not differentiated; lacking a central strand. **Leaves** in up to 6 pairs, upper leaves much longer than lower leaves; crisped when dry; lanceolate to ovate-lanceolate, to 2 mm long, 0.5 mm wide; apex acute; laminae unistratose, limbate; **limbidium** narrow, 1(–2) cells wide, unistratose or occasionally 2 cells thick, ceasing shortly below leaf apex, often indistinct on vaginant laminae; **vaginant laminae** narrow, $^{1}/_{3}$–$^{1}/_{2}$ leaf length, almost closed to closed, apex acute; **margins** entire, occasionally weakly dentate at apex; **laminal cells** irregularly hexagonal, 30–60 µm long, 20–30 µm wide; **costa** absent, but at junction of laminae several cells thick in section.

Monoicous (autoicous). Perigonia terminal on male branches at base of female stems. **Perichaetia** terminal; **perichaetial leaves** not differentiated from stem leaves. **Setae** colourless, becoming yellowish with age, to 3 mm long, smooth; **capsules** erect, symmetric, 0.4–0.7 mm long; **exothecial cells** ±quadrate to short rectangular, thin-walled, distinctly collenchymatous; **operculum** rostellate to rostrate, 0.2–0.5 mm long; **peristome** of *Scariosus*-type, 30–35 µm wide at base, *c.* 150 µm long. **Calyptra** campanulate to mitrate, cells smooth to ±bulging, *c.* 0.4 mm long. **Spores** 9–13(–17) µm in diameter, finely papillose.

Occurs in Qld.

Grows on earth banks in tropical rainforest.

Also found in eastern North America, Mexico, Taiwan, Japan, India, tropical Asia, New Guinea, New Caledonia.

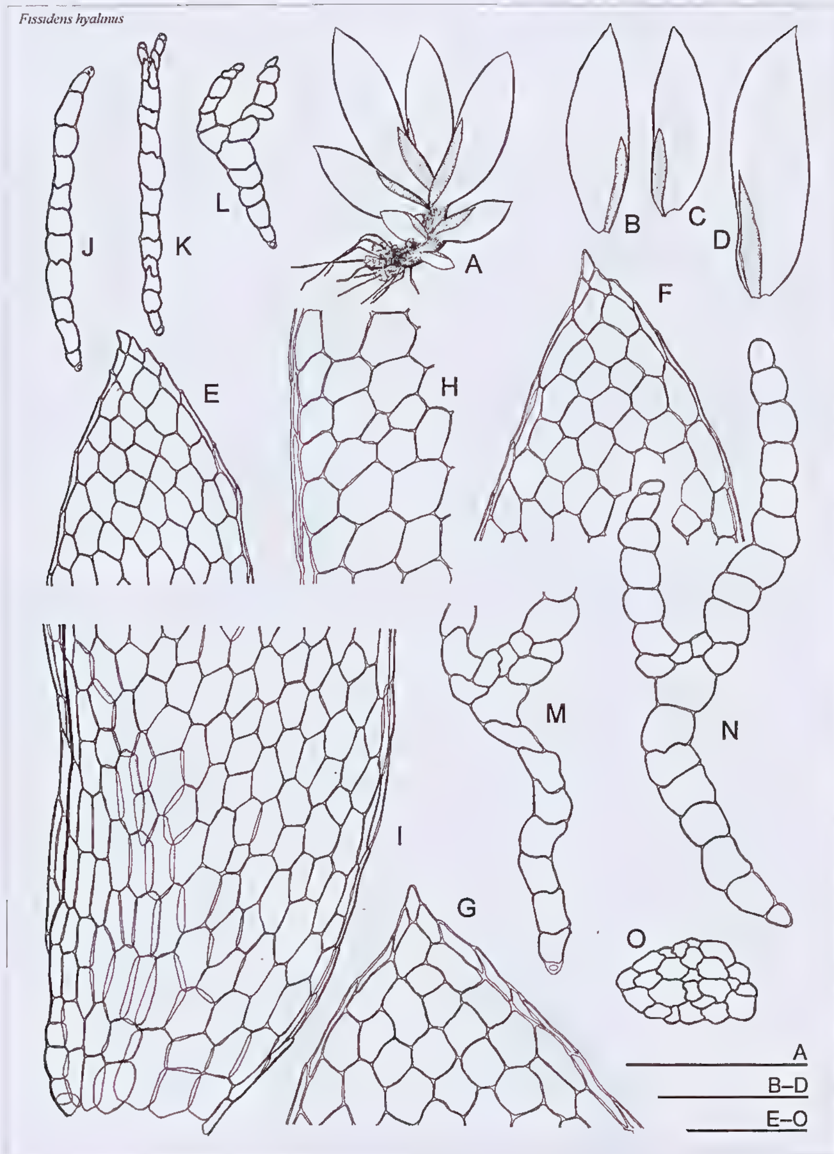

Fig. 2. ***Fissidens hyalinus*** Hook. & Wilson.
Drawn from: Qld., Tully Falls, lower track, *I.G.Stone 19875*, 04 Jul 1982 (MEL 2246102).

A. Plant; **B–D.** Stem leaves; **E–G.** Cells of leaf apex; **H.** Cells of mid lamina; **I.** Cells of basal part of leaf. **J.** Section of apical part of leaf; **K.** Section of leaf shortly below junction of vaginant laminae; **L–N.** Sections of leaf through dorsal and vaginant laminae; **O.** Stem section.

Scales: = 1.0 mm (A); = 1.0 mm (B-D); = 100 μm (E-O).

SELECTED SPECIMENS EXAMINED: Qld.: Lower track, Tully Falls, *I.G.Stone 19875* (MEL 2246102); Mt. Omega from St. Helen's gap, S of Calen, *D.H.Norris 39184 p.p.* (associated with *F. angustifolius* Sull., *F. zollingeri* Mont., as MO 6492017). Japan: Shukuya Fall, Saitama Pref. *H. Kikuchi* det. Z. Iwatsuki (H. Inoue: Bryophyte Selecta Exsiccata 481).

Fissidens hyalinus (as *F. nymanii*) was first reported for Australia from collections made from Tully Gorge, tropical Queensland, and a comparison made with *F. dealbatus* and *F. splachnoides* (Stone 1985b). Morphologically, these species appear very closely related, sharing most of their defining characters. Stone (1985b) considered the calyptra the most critical distinguishing feature. However, most of the herbarium specimens lack sporophytes and thus morphological characters of the gametophyte plants remain the most available distinguishing features.

Size of plants, cell size, shape of leaves and the vaginant laminae yield no reliable distinguishing characters. The only reliable feature available for distinguishing the taxa appears to be the anatomy of the limbidium, a conclusion also reached by R. Pursell (pers. comm. 18 December 2013).

A detailed comparative morphological study of Australian material of *F. hyalinus, F. nymanii, F. dealbatus* and material attributed to *F. splachnoides* has led to the conclusion that only two species are represented in Australia: *F. hyalinus* and *F. dealbatus*.

In *F. hyalinus*, sections of the limbidium reveal cells that are thinner-walled than in *F. dealbatus* and the limbidium is 1(–2) cells wide and 1(occasionally 2) cells thick. In *F. dealbatus*, the limbidium is composed of cells that are very thick-walled with a very narrow lumen, (1–)2(–3) cells in width and 1–4(–5) cells in thickness.

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THE MOSS GENUS *FISSIDENS* IN TASMANIA

R.D. Seppelt

Seppelt, R.D. 2014. The moss genus *Fissidens* in Tasmania. *Kanunnah* 7: 78–126. ISSN 1832-536X. Fourteen species of the moss genus *Fissidens* are presently recognised from Tasmania. A key to the taxa and descriptions and full illustrations are provided for all species and varieties. Although reported for Tasmania and included here in the key to species and provided with description and illustration, no authentic collections of *F. berteroi* (Mont.) Müll.Hal. from the State have been located in any Australian herbaria and the species is consequently considered as doubtful for the state's flora.

R.D. Seppelt, Tasmanian Herbarium,
PO Box 5058, UTAS LPO, Sandy Bay, Tasmania 7005.
Email: rod.seppelt@tmag.tas.gov.au

KEY WORDS: Fissidentaceae, Fissidens, Tasmania, moss flora, Australian mosses

INTRODUCTION

Around 900 species of the moss genus *Fissidens* have been described worldwide, although only some 450 species are currently recognised, with most species being found in tropical and subtropical regions. Within Australia there are at least 70 species and intraspecific taxa (Seppelt & Stone, Flora of Australia: Mosses, in prep.). Fifteen species are represented in the Tasmanian flora, with one doubtfully occurring species.

The moss genus *Fissidens* Hedw. is easily recognised by its unique leaf structure. Leaves are always clearly distichous (in two rows) on the stems, giving the appearance of a miniature fern frond. The leaf structure is complex in form, resembling the letter Y in section and consisting of two vaginant laminae that clasp the stem and are joined only along the costa (open), or joined above from the costa to the margin (closed), or the minor lamina is joined by a shorter suture extending part way from the costa to the margin (part open or part closed). A wing-like dorsal laminae on the abaxial side of the costa extends the length of the leaf and reaches the leaf base, ceases above the base or, rarely, may be decurrent on the stem. The margins of the leaf may be smooth or denticulate by projecting cell ends and may or may not be bordered (limbate). The cells of the border, when present, are usually elongate and often considerably so, mostly thick-walled and clearly differentiated from the adjacent

lamina cells. The border may be present on all laminae or be restricted to the vaginant laminae and sometimes is only present on the vaginant laminae of the perichaetial leaves of fertile plants. Leaf cells may be smooth, mammillose or papillose.

Plants are often found without sporophytes, making accurate determination sometimes difficult, and collections often include one or more species. Many species have short stems and entire plants with the leaves may be only a few millimetres tall. Some species are aquatic to semi-aquatic, occurring on rock in flowing water, while others are found on soil, rock, tree roots and bark in drier habitats. Some species are regularly found as colonists of bare soil on exposed banks or on open soils where competition is minimal.

In the following treatment, detailed descriptions and illustrations accompany all taxa, and a key to the Tasmanian species and varieties is included. Synonyms are given only if their relevant types are of Tasmanian origin.

THE GENUS *FISSIDENS*

FISSIDENS Hedw., *Sp. Musc. Frond.* 152 (1801); from the Latin *fissio* (a split or cleft) and *dens* (a tooth), referring to the divided peristome teeth of most species. Lectotype: *F. bryoides* Hedw.

Plants usually minute, 1–3 mm long, to medium-sized, or more than 10 cm in aquatic species. **Stems** simple or branched, growing from a 2-sided apical cell except at the earliest stage; **rhizoids** smooth. **Leaves** distichous, complanate, equitant, linear to lanceolate, plain to falcate; complex in form, consisting of 2 vaginant laminae clasping the stem and joined only along the costa (vaginant lamina open), or joined above from the costa to the margin (vaginant lamina closed), or with the minor lamina joining by a shorter suture extending part way to the margin (part open); apical lamina above the vaginant lamina small or large, dorsal (abaxial) lamina extending the length of the leaf, reaching the leaf base, ceasing above or rarely decurrent; **cells of apical and dorsal lamina** thin- to thick-walled, smooth, mamillose, uni- or multi-papillose, the surface flat to strongly bulging, sometimes lenticularly (convexly) thickened, usually small, isodiametric, occasionally longer (especially near the leaf base); **cells of vaginant lamina** often larger, more elongate; **marginal cells** differentiated or not; **costa** single, usually well-developed, failing below the apex to shortly excurrent, sometimes reduced, absent or nearly so.

Dioicous or **monoicous**. **Perigonia** terminal or lateral. **Perichaetia** terminal, rarely lateral; **perichaetial leaves** often longer and/or narrower than vegetative leaves, vaginant lamina open. **Setae** smooth, infrequently papillose, mostly elongate, erect, often geniculate at the base. **Capsules** erect to inclined, cylindric, symmetric or asymmetric. **Operculum** conical and apiculate to rostrate. **Peristome** single, endostomate, of 16 teeth, usually divided to $^1/_2$–$^2/_3$ length (rarely entire to rimose), the arms filamentous. **Calyptra** cucullate, rarely mitrate.

KEY TO *FISSIDENS* IN TASMANIA

1 Leaves with a well-defined costa; lamina cells small to medium-sized, mostly < 25 µm long, thin- to thick-walled .. 2

1' Leaves seemingly lacking a costa, or costa rudimentary and incomplete; lamina cells large, thin-walled, *c.* 15 µm of more long; limbidium bi- multi-stratose with strongly prosenchymatous cells; vaginant laminae $^1/_2$–$^2/_3$ leaf .... ***Fissidens dealbatus***

2 Leaves with a limbidium on apical, dorsal and vaginant laminae 3

2' Leaves with limbidium confined to the vaginant laminae, or incomplete not reaching apical lamina, or elimbate .. 8

3 Lamina cells small, 5–10 (–15) µm long 4

3' Lamina cells larger, (12–)15–40 µm long..5

4 Stems to 6 cm long; leaves oblong to lanceolate, 2.5–4.0 mm long, 0.6–0.7 mm wide; limbidium strong, multistratose; margins entire; lamina cells obscure; plants aquatic or in wet places, on rock or soil .... ***Fissidens rigidulus***

4' Stems shorter, to 10(–20) mm long; leaves 0.5–2.0 mm long, 0.15–0.50 mm wide; limbidium 1–4-stratose, 1–4(–6) cells wide; plants generally not aquatic, in moist to drier places 5

5 Limbidium (1–)2–4) stratose, 2–4 cells wide; lamina cells 5–16 µm 6

5' Limbidium 1–3(–4) cells thick, 1–4(–6) cells wide; lamina cells small, to 6 µm, firm-walled, strongly convex, rounded-hexagonal to pentagonal, smooth or obscurely bi-papillose; margins of vaginant laminae coarsely crenate-dentate .... ***Fissidens megalotis***

6 Limbidium 2–4 stratose; lamina cells 8–16 µm 7

6' Limbidium unistratose; lamina cells 5–9 µm .... ***Fissidens leptocladus***

7 Limbidium complete or almost complete on all laminae .... ***Fissidens curvatus*** var. ***curvatus***

7' Limbidium vestigial or absent on dorsal and apical laminae .... ***Fissidens curvatus*** var. ***inclinabilis***

8 Leaves lacking a limbidium 9

8' Leaves with limbidium restricted to vaginant laminae, or incomplete, reaching to mid-leaf or just beyond, sometimes restricted to perichaetial or perigonial leaves 16

9 Lamina cells smooth 10

9' Lamina cells mammillose or papillose 11

10 Plants aquatic, emergent or submerged, in wet places; leaves broadly lingulate-lanceolate, 2.5–4.0 mm long, 0.8–1.3 mm wide, *c.* 4 times as long as wide, apical margins sharply and irregularly dentate, teeth visible with x10 hand lens .... ***Fissidens adianthoides***

10' Plants aquatic, blackish-green with green shoot tips; leaves linear, to *c.* 2.0 mm long, 0.2–0.3 mm wide; costa strong, subpercurrent; apical and dorsal laminae bi- to multistratose near costa, elsewhere unistratose; lamina cells ±rounded, 12–14 µm, smooth to slightly convex, thick-walled; lamina margins minutely crenulated, not visible with x10 hand lens .... ***Fissidens strictus***

11 Plants 2–10 mm long 12

11' Plants 5–20(–40) mm long 15

12 Lamina cells uni- to multi-papillose; margin of vaginant laminae of at least the lower leaves conspicuously serrate (*Fissidens tenellus*) 18

12' Lamina cells smooth or mammillose; marginal cells of vaginant laminae not conspicuously serrate 13

13 Peristome teeth entire, rimose or occasionally weakly split, papillose, ±erect whether dry or moist; leaves of sterile shoots subobtuse-apiculate to acute; costa usually percurrent .... ***Fissidens taylorii*** var. ***sainsburyanus***

13' Peristome teeth forked, the arms spirally ornamented, recurved when dry, strongly incurved when moist; leaves of sterile shoots obtuse, subobtuse or acute; costa subpercurrent to short-excurrent 14

14 Sterile shoots 2–4 mm tall; leaves 0.30–0.85 mm long; apex obtuse, subobtuse-apiculate to acute; perigonia occasionally separate, often single and axillary at the base of sterile or perichaetial shoots, or numerous and axillary, the leaves then short, obtuse or obtuse-apiculate .... ***Fissidens taylorii*** var. ***taylorii***

14' Sterile shoots 5–10 mm tall; leaves 0.5–1.0 mm long; apex acute; perigonia numerous in leaf axils; female shoots 1 or more, axillary near the base .... ***Fissidens taylorii*** var. ***epiphytus***

15 Plants pale whitish-green to green; leaves linear-lanceolate, 1.5–3.0 mm long, 0.3–0.35 mm wide; vaginant laminae $^1/_2$–$^2/_3$ leaf, half closed; lamina cells smooth .... ***Fissidens pallidus***

15' Plants yellowish-green to dark green; leaves oblong-lanceolate to linear-lanceolate; lamina cells mammillose 16

16 Plants 10–30 mm tall; leaves oblong-lingulate, 2.0–3.0 mm long, strongly coiled when dry; vaginant laminae *c.* $^1/_4$ leaf length, open or nearly so, the apex rounded; dorsal lamina tapering to the base, mostly ending above insertion; lamina cells irregularly rounded-hexagonal, 7–15 µm; costa failing 5–12 cells below apex .... ***Fissidens asplenioides***

16' Plants 10–15 µm long; leaves oblong-lanceolate, 2.0–3.5 mm long, 0.65–0.75 mm wide; vaginant laminae $^1/_2$–$^2/_3$ leaf, ending obliquely, closed or nearly so; dorsal lamina tapered to the base, often failing above the insertion; lamina cells small, *c.* 8 µm, obscure; costa failing below the apex .... ***Fissidens oblongifolius***

17 Lamina cells smooth 18

17' Lamina cells mammillose 19

18 Plants usually growing on rock, occasionally on soil; leaves more than 5 time longer than wide; cost percurrent, occasionally excurrent; setae 2–5(–10) mm long .... ***Fissidens tenellus*** var. ***tenellus***

18' Plants growing on bark, occasionally on peat or humus; leaves usually less than 5 times as long as wide; costa ending 2–4 cells below the apex; setae 2–3 mm long .... ***Fissidens tenellus*** var. ***australiensis***

19 Plants not aquatic, in moist to drier places 20

19' Plants aquatic, emergent, or in wet places; leaves overlapping, broadly lingulate-lanceolate, 2.5–4.0 mm long, 0.8–1.3 mm wide, *c.* 4 x as long as wide; apical margins sharply and irregularly dentate .... ***Fissidens adianthoides***

20 Vaginant laminae to $^3/_4$ or more leaf length; fertile plants 1–4 mm long, sterile plants to 10 mm long 21

20' Vaginant laminae reaching $^1/_2$–$^3/_4$ leaf 24

21 Leaf apex sharply recurved, cultriform; costa percurrent to excurrent; lamina cells 8–10(–20) µm; vaginant laminae with limbidium weak on stem leaves, on perichaetial leaves broad proximally, narrowing above and often extending into apical lamina .... ***Fissidens bifrons***

21' Leaf apex not sharply recurved; costa subpercurrent; lamina cells 8–20 µm long, vaginant laminae with weak limbidium or elimbate; fertile plants 2–4 mm long, sterile stems to 10 mm long; 22

22 Peristome teeth entire, rimose or occasionally weakly split, papillose, ±erect whether dry or moist; leaves of sterile shoots subobtuse-apiculate to acute; costa usually percurrent .... .. ***Fissidens taylorii*** var. ***sainsburyanus***

22' Peristome teeth forked, the arms spirally ornamented, recurved when dry, strongly incurved when moist; leaves of sterile shoots obtuse, subobtuse or acute; costa subpercurrent to short-excurrent 23

23 Sterile shoots 2–4 mm tall; leaves 0.30–0.85 mm long; apex obtuse, subobtuse-apiculate to acute; perigonia occasionally separate, often single and axillary at the base of sterile or perichaetial shoots, or numerous and axillary, the leaves then short, obtuse or obtuse-apiculate .... ***Fissidens taylorii.*** var. ***taylorii***

23' Sterile shoots 5–10 mm tall; leaves 0.5–1.0 mm long; apex acute; perigonia numerous in leaf axils; female shoots 1 or more, axillary near the base .... ***Fissidens taylorii*** var. ***epiphytus***

24 Plants 1–5(–8) mm long, yellow-green, glossy, scattered; leaves oblong-lanceolate or linear-lanceolate, 0.5–1.5(–2.0) mm long, 0.15–0.30(–0.5) mm wide; margins entire; lamina cells

smooth, flat, irregular in shape, rounded or angular, ±hexagonal to rhomboid or rectangular, 8–15 μm; vaginant laminae $^1/_2$–$^3/_4$ leaf; limbidium 2–4 stratose, ... 25

24' Plants 5–25 mm long, dark green to blackened, usually densely tufted; leaves oblong-lanceolate, 1.0–2.0 mm long, 0.2–0.4 mm wide; margins weakly serrulate by projecting cell ends; vaginant laminae $^1/_2$–$^2/_3$ leaf, open to half closed; limbidium usually distinct, sometimes obscure or absent, intramarginal, of 1–3 rows of elongate vermicular, linear cells; lamina cells thick-walled, subquadrate to hexagonal, smooth not bulging, 10–15 μm .... ***Fissidens integerrimus***

25 Limbidium complete on all laminae ..... ***Fissidens curvatus*** var. ***curvatus***

25' Limbidium vestigial or absent on dorsal and apical laminae .... ***Fissidens curvatus*** var. ***inclinabilis***

Fissidens adianthoides Hedw., *Sp. Musc. Frond.* 157 (1801)

TYPE: Europe; *n.v.* (*fide* Pursell 1986, *Bryologist* 89: 39)

ILLUSTRATIONS: J.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key.* 12 (2002); A.J.E.Smith, *The Moss Flora of Britain and Ireland.* 2nd edn, 257, fig. 7–10 (2004); (**Fig. 1**)

Plants robust, 2–5 cm long, the shoots 5–6 mm broad, yellowish-green to deep green. **Stems** densely tufted, branching occasionally, in section with a narrow central strand. **Leaves** close together on the stems, the bases slightly overlapping, patent, slightly falcate when moist, the apices crisped and rolled up when dry, broadly lingulate to lingulate-lanceolate, 2.5–4.0 mm long, 0.8–1.3 mm wide; **apex** acute to obtuse and apiculate; **laminae** unistratose; **margins** crenulated below, sharply and irregularly dentate towards the apex; **vaginant laminae** up to $^1/_2$–$^2/_3$ leaf length, half open; **dorsal lamina** rounded to the base, ending at the insertion of shortly decurrent; **cells of apical and dorsal laminae** ±isodiametric, rounded hexagonal, 12–18 μm wide, thick-walled, opaque, 3–4 marginal rows more pellucid and thick-walled, forming a paler border; **costa** of *taxifolius*-type, subpercurrent to percurrent, mostly ceasing 2–4 cells below the apex.

Autoicous or **?dioicous**. **Perigonia** axillary in clusters about mid-stem. **Perichaetia** single in axils of leaves about mid-stem; **perichaetial leaves** reduced. **Setae** orange-brown, slender, sinuose, to 20 mm in length. **Capsules** erect to horizontal, asymmetric, 1.0–1.6 mm long; **exothecial cells** rectangular-hexagonal, thick-walled, 32–45 μm long, 11–25 μm wide, in *c.* 10–110 columns around the periphery at mid-capsule. **Operculum** to 1.5 mm long, curved-rostrate. **Peristome** of *taxifolius*-type; base of teeth 90–110 μm wide, the outer surface with low trabeculae and finely pitted lamellae; filaments slightly twisted, nodulose, with oblique striae between the nodules for most of their length. **Calyptra** smooth, cucullate. **Spores** 13–33 μm in diameter, very finely and obscurely papillose, appearing smooth.

In Australia, known from Vic., Tas.

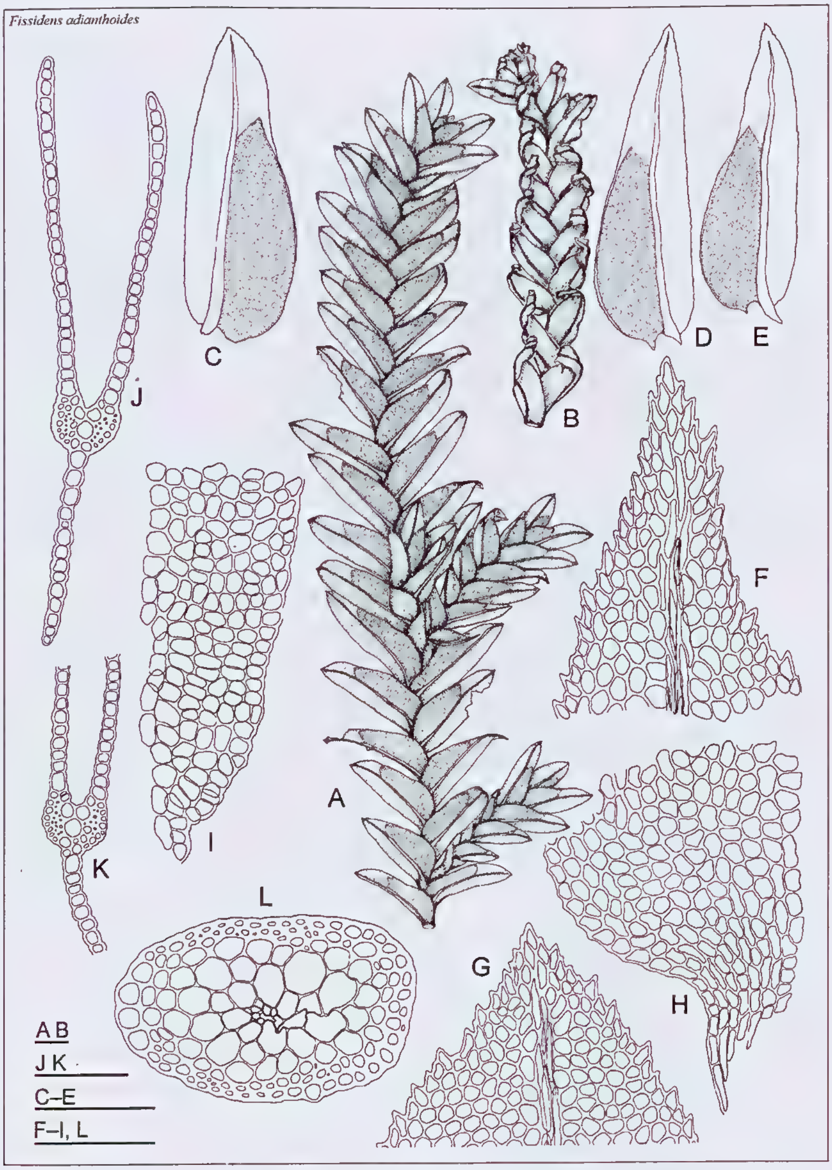

Fig. 1. ***Fissidens adianthoides*** Hedw.
Drawn from: Tasmania: Nile River, Lymington, *R.McLeod 750.* (HO 75550).

A. Plant, drawn moist, upper surface view; **B.** Plant, drawn dry, view from lower side; **C–E.** Stem leaves; **F, G.** Cells of leaf apex; **H.** Cells of basal part of vaginant lamina; **I.** Cells of basal part of dorsal lamina; **J, K.** Leaf sections; **L.** Stem section.

SCALES: = 1.0 MM (A, B); = 1.0 MM (C–E); = 100 μM F–I, L); = 100 μM (J, K).

Also known in New Zealand, Chile, Tierra del Fuego. Widespread in circumpolar temperate regions, in Europe north to Svalbard, Faeroes, Iceland, Japan, China, Azores, Madeira, North America.

SELECTED SPECIMENS EXAMINED: Tasmania: Nile River, Lymington, *R.McLeod 750* (HO 75550); Lake St. Clair, *L.Rodway* (HO 75548); Central Highlands, Wild Dog Plains, *A.Moscal 22827* (HO 300469); Central Highlands, Lake Antimony, *A.Moscal 22644* (HO 300470); Meander River, *A.Moscal 12477* (HO 108167); East Coast, Prosser River, *A.Moscal* 19612 (HO 77849). England: Hurstpierpoint, ex Hb. Mitten (HO 83670 – c.fr.).

This is a large species of moist habitats and may also occur in water bodies. When moist, the leaf tips are curved slightly towards the substratum and when dry, the leaves are distinctly twisted and curled towards the ventral side of the shoots.

Sexuality of the Australian material is unclear. Scott and Stone (1976) did not find fertile material. Noguchi (1987) indicates the species is monoicous, other authors, including Pursell (2007) and Beever *et al.* (2002), indicate the species is dioicous, while Smith (2004) states the species is autoicous or dioicous.

Details of the sporophyte are taken from Smith (2004), Pursell (2007), and from a British specimen (England: Hurstpierpoint, ex Hb. Mitten. HO 83670 – c.fr.). The spores of the British specimen measure 21–29 in diameter and while appearing smooth are very finely and obscurely papillose. The exothecial cells are very thick walled and irregularly elongate-hexagonal to rhomboid or rectangular.

Fissidens asplenioides Hedw., *Sp. Musc. Frond.* 156. (1801)

TYPE: Jamaica, *O.Swartz*; Holotype: G *n.v.*; Isotype: NY *n.v.*

ILLUSTRATIONS: G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia* 85, pl. 7; 87, pl. 8; 89, pl. 9 (1976); J.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key* 16 (2002); H.Streimann, *The Mosses of Norfolk Island* 75, fig. 31 (2002); D.Meagher & B.Fuhrer, *A Field Guide to the Mosses and Allied Plants of Southern Australia* 39 (2003). (**Fig. 2**)

Plants growing on soil or sometimes in water, 10–30 mm tall, yellow-green to dark green, brown or blackened below, densely gregarious. **Stems** simple or occasionally branched; in section with a strong central strand of small thin-walled cells. **Leaves** in numerous pairs, crowded, imbricate at the base, patent, falcate when moist, oblong-lingulate, 2.0–3.0 mm long, strongly coiled when dry; **apex** obtuse to rounded; **margins** serrulate on the dorsal and apical laminae, irregularly so near the apex; **vaginant laminae** about $^{3}/_{4}$ leaf length, open or nearly so, rounded above, joining at or near the costa; margins crenulate to weakly serrulate; **dorsal lamina** tapering at the base, mostly ending above the insertion; **lamina cells** of the dorsal and apical laminae irregularly rounded hexagonal, mostly 7–15 μm diam., mammillose; **costa** of *oblongifolius*-type, ceasing 5–12 cells below the apex.

Dioicous. **Perigonia** terminal on stems. **Perichaetia** terminal on stems. **Perichaetial leaves** longer than vegetative leaves, the apices acute. **Setae**

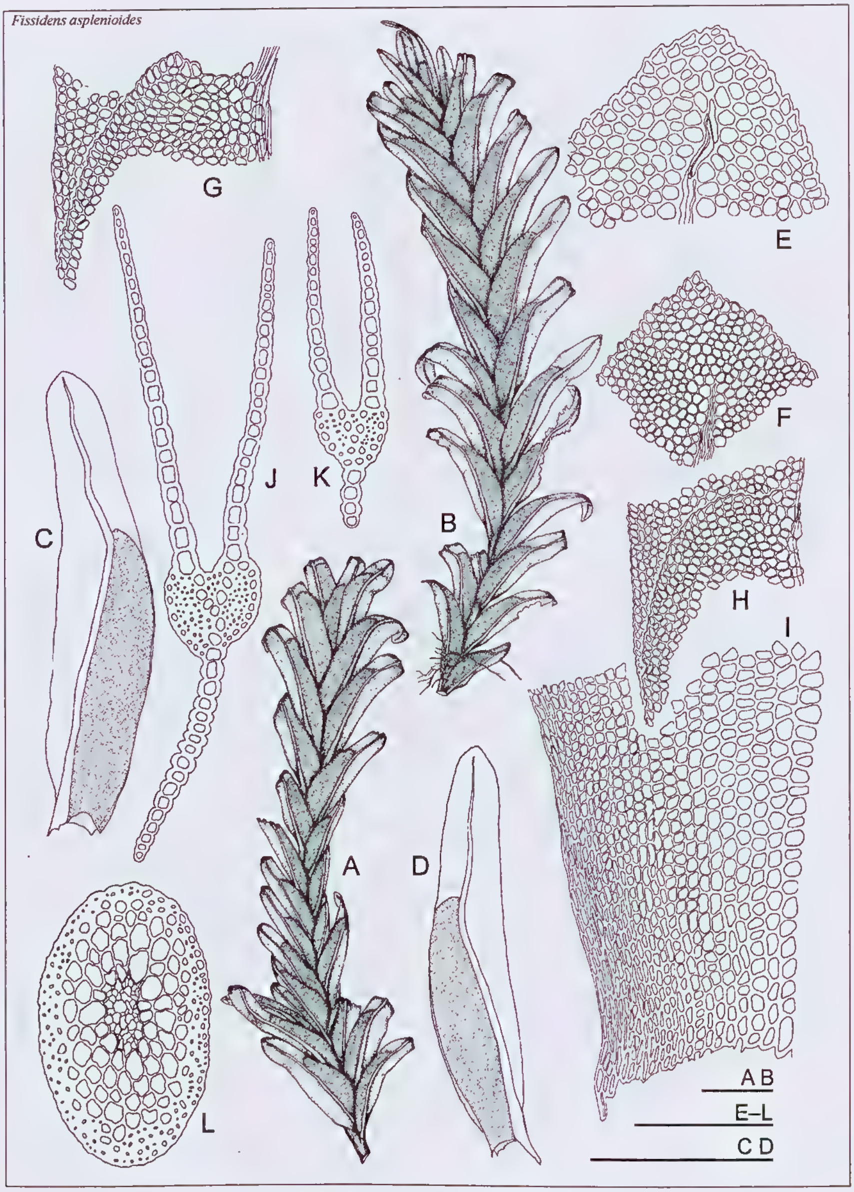

Fig. 2. ***Fissidens asplenioides*** Hedw.
Drawn from: Tasmania: East Coast, Douglas River, *A.Moscal 19571* (HO 300484).
A, B. Plants, drawn moist; **C, D.** Stem leaves; **E, F.** Cells of leaf apex; **G, H.** Cells of apical part of vaginant laminae; **I.** Cells of proximal part of vaginant lamina; **J, K.** Leaf sections; **L.** Stem section.
SCALES: = 1.0 MM (A, B); = 1.0 MM (C, D); = 100 μM (E–L).

terminal, to 5 mm long, yellow to orange-brown, stout, arcuate. **Capsules** inclined, asymmetric, oblong, 1.0–1.5 mm long. **Operculum** rostrate, often oblique, ± equal in length to capsule. **Calyptra** smooth, cucullate. **Peristome teeth** of *fasciculatus*-type; basal part 65–100(–110) μm wide, with low trabeculae on the outer face and with low vertical smooth or papillose ridges, continuing into the bases of forks; forks distally coarsely papillose. **Spores** 14–16 μm diam.

In Australia, known from W.A., N.T. (doubtful), S.A., Qld, N.S.W., A.C.T., Vic., Tas. Also known from Lord Howe Island, Norfolk Island.

Elsewhere, common in New Zealand and widespread in tropical and subtropical regions of the world.

SELECTED SPECIMENS EXAMINED: Tasmania: Dip Falls, S of Stanley, *I.G.Stone 25254* (MEL); East Coast, Douglas River, *A.Moscal 19571* (HO 300484); Hobart Rivulet, *W.A.Weymouth 2105* (HO 73315); Styx River, *R.Lovatt s.n.*, 06 Dec 2007 (HO 568580); West Coast, Huskisson River, *A.Moscal 21073* (HO 323026); Middlesex Plains, *L.Rodway s.n.,* Dec. 1915 (HO 75552); Port Cygnet, Agnes River, *W.A.Weymouth 2128* (HO 73322).

Beever *et al.* (2002) state that the rounded apex of the vaginant lamina is a characteristic feature of the species.

Fissidens bifrons Schimp. ex Müll.Hal., *Bot. Zeitung (Berlin)* 17: 198 (1859)

TYPE: South Africa: Cape of Good Hope, *Breutel.* Isotype: BM.

ILLUSTRATIONS: D.G.Catcheside, *Mosses of South Australia* 76, fig. 16. (1980 – as *F. splachnifolius* auct. non Hornsch.). (**Fig. 3**)

Plants small, yellow-green; sterile shoots 2–10 mm long, often growing from the base of a female plant. **Stems** slender, elongate; in section with a narrow central strand of small, thin-walled cells; rhizoids basal. **Leaves** distant, in 6–20 or more pairs, cultriform, 0.2–0.5 mm long, 0.1–0.2 mm wide; **apex** sharply recurved, acute; **laminae** unistratose; **margins** entire to serrulate; **vaginant laminae** reaching to $^{3}/_{4}$–$^{4}/_{5}$ leaf length, fully open to part open, elimbate except on largest leaves, where present, **limbidium** of 3–6 rows of narrow elongate cells; **dorsal lamina** elimbate, failing above the insertion to shortly decurrent; **laminal cells** small, irregularly quadrate to polygonal, *c.* 8–10 μm wide, ±rectangular and up to 20 μm long proximally in the vaginant laminae. **Costa** of *bryoides*-type; percurrent to excurrent.

Dioicous. Fertile plants 2–5 mm long, the leaves cultriform or straight, to *c.* 1 mm long, 0.25–0.30 mm wide. **Perichaetia** terminal; **perichaetial leaves** to 1.5 mm long, costa percurrent to excurrent; limbidium of vaginant laminae broad below, narrowed above, often just extending into the apical lamina. **Setae** terminal, flexuose, 7–15 mm long. **Capsule** asymmetrical, curved, theca *c.* 0.6 mm long; **exothecial cells** short rectangular, 30–40 μm long, 20–30 μm wide, thin-walled, the corners not or weakly collenchymatous. **Calyptra** not seen. **Operculum** short rostrate. **Peristome** of *bryoides*-type, reddish, 260–290 μm long, 45–50 μm wide at the base. **Spores** 12–17 μm in diameter.

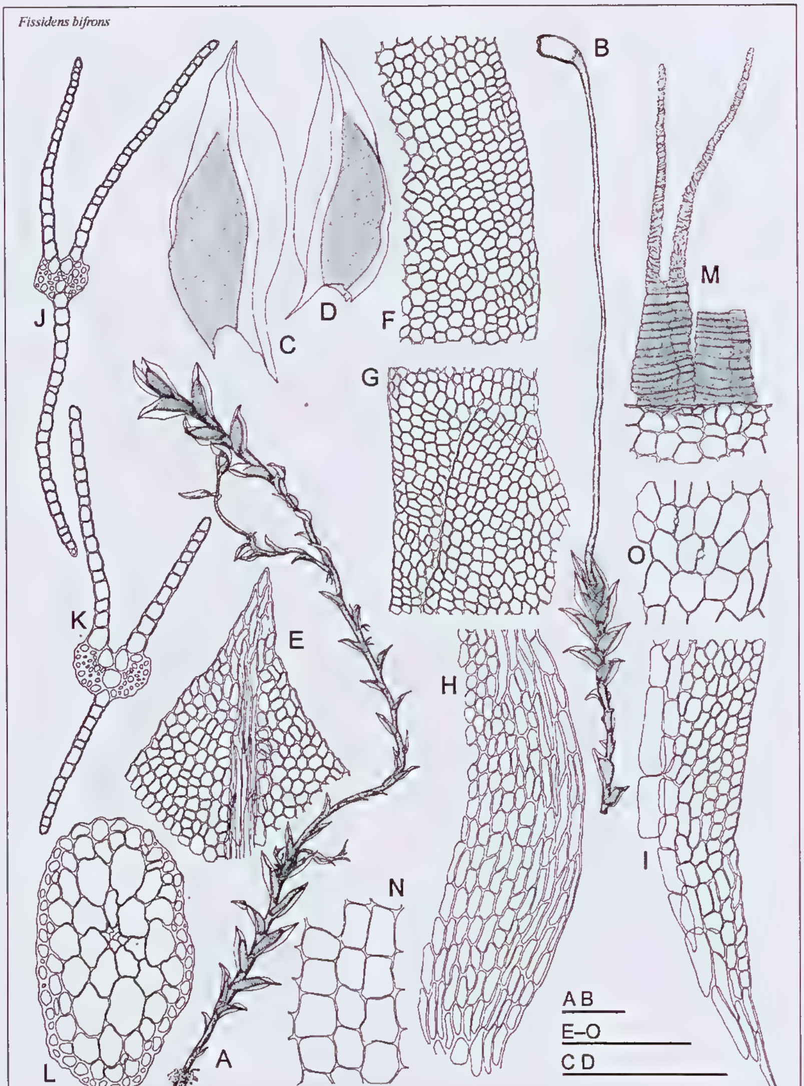

Fig. 3. *Fissidens bifrons* Schimp. *ex* Müll.Hal.
Drawn from: New South Wales: Central Coast, *W.Forsyth 676*. (MEL 29290). Isotype of *Fissidens bryoidioides*.

A. Flagelliform sterile shoot; **B.** Fertile shoot; **C, D.** Stem leaves; **E.** Cells of leaf apex; **F.** Cells of dorsal lamina opposite apex of vaginant laminae; **G.** Cells of apical part of vaginant laminae; **H.** Cells of basal part of vaginant lamina; **I.** Cells of basal part of dorsal lamina; **J, K.** Leaf sections; **L.** Stem section; **M.** Peristome teeth; **N.** Exothecial cells; **O.** Stomata from base of theca.

Scales: = 1.0 mm (A, B); = 1.0 mm (C, D); = 100 μm (E–O).

In Australia, occurs in southern W.A., south-eastern S.A., eastern N.S.W., southern Vic., and on the west coast of Tas.

Also occurs in South Africa.

SELECTED SPECIMENS EXAMINED: Tasmania: West coast, road to Arthur Creek, *I.G.Stone 25275* (MEL). Western Australia: Hoves Falls, Forrest Natl Park, *I.G.Stone 6202B* (MEL). South Australia: Bellevue Heights, near Adelaide, *D.G.Catcheside 75.78* (AD). New South Wales: Penshurst, *W.Forsyth 679* (MEL 29290). Victoria: Tallarook, *I.G.Stone 9318* (MEL); Main ridge near Red Hill, Mornington Peninsula, *I.G.Stone 9599* (MEL).

There are no Tasmanian collections in the Tasmanian Herbarium. As with most other species occurring in Tasmania, the lack of available collections reflects a general lack of awareness of the habitats, occurrence and diversity of *Fissidens* within the State.

Terrestrial and often growing in weedy places, *F. bifrons* varies greatly in size depending on the habitat. It often has delicate flagelliform innovations, consisting of alternating sequences of minute and very distantly set and larger cultriform leaves, arising from within the terminal perigonia, perichaetia or leaf axils.

Magill (1981) regarded *F.bifrons* as a synonym of *F. pygmaeus* Hornsch., but the latter has non-arcuate, ±asymmetrical capsules, short setae (*c.* 1–5 mm long), larger spores, and small vegetative leaves with a marginal limbidium on the vaginant laminae.

Fissidens curvatus Hornsch., *Linnaea* 15: 148 (1841)

TYPE: South Africa: Cape Prov., an einer Mauer in Mr Aurets Garten unter dem Löwenrücken, *Ecklon s.n.*, 24 Oct 1827. Lectotype: H–BR – designated by Magill (1981) – *fide* Pursell, *Bryologist* 97: 256. (1994) Isotypes: BM, S.

Fissidens pungens Müll.Hal. & Hampe, *Linnaea* 26: 502 (1855) *fide* Bruggeman-Nannenga & Pursell, *Lindbergia* 20: 50 (1995). Type: Australia, South Australia, Barossa Range, *F.Mueller* 3 (MEL 76168 – an Isotype *fide* I.G.Stone, *J. Bryol.* 16: 262 (1990)

Plants small, scattered, yellow-green, glossy, dimorphic, growing on soil. **Stems** 1–5(–8) mm long, simple; in section with a central strand. **Leaves** larger above, slightly contorted when dry, erect-spreading when moist; linear-lanceolate, 0.5–2.0 mm long, 0.15–0.5 mm wide; **margins** entire, **limbate** throughout (except var. *inclinabilis*); **limbidium** strong, 2–4 seriate; **vaginant laminae** reaching $^1/_2$–$^2/_3$(–$^3/_4$) leaf length, apex half open to closed; **dorsal lamina** tapered to the base, mostly ending above the insertion; **lamina cells** irregular in shape, rounded, angular, ±hexagonal, to rhomboid or rectangular, 8–15 µm long, smooth, flat, becoming rectangular towards the insertion. **Costa** of *bryoides*-type, joining with the marginal limbidia at the apex.

Polyoicous. Perigonia gemmiform, axillary or rhizautoicous. **Perichaetia** terminal. **Perichaetial leaves** with vaginant laminae open to half open. **Setae** to 5 mm long, yellow to orange-brown.

Capsule ovate, asymmetric, inclined, to 1.0 mm long; **exothecial cells** quadrate to short-rectangular, weakly collenchymatous. **Operculum** rostrate. **Peristome** of *bryoides*-type, reddish, 300–400 µm long, 35–55 µm wide at base. **Spores** (9–)12–17(–20) µm.

Fissidens curvatus is a very variable moss in size of the plants and width of the leaves. Typically, the species is dimorphic, the sterile stems having smaller, more numerous and more or less uniform leaves. Fertile plants are shorter, with terminal subperichaetial and perichaetial leaves much larger than the lower leaves. The species is amongst the most widespread of the genus.

Stone (1990b) placed the Australian *F. aristatus* Broth., *F. sordidivirens* Broth., *F. wildii* Broth., and *F.warningensis* Broth. *ex* Burges (*nom. nud.)* in synonymy of *F. pungens*, but later (Stone 1994) changed her opinion and recognised both *F. aristatus* and *F. pungens* as distinct, primarily on the basis of plant size. *Fissidens curvatus* is among the most widespread species of the genus *Fissidens*, a highly variable species with an extensive synonymy (Bruggeman-Nannenga & Pursell 1995). The stems are often dimorphic, infertile or sterile stems being longer with a greater number of leaves than fertile (perichaetial) stems. *Fissidens aristatus* and *F. pungens* are both considered here as synonyms of *F. curvatus* var. *curvatus*. The small, narrow leaves and strong, yellowish border are useful identifying features.

Two varieties are known to occur in Australia. Both are found in Tasmania.

1 Limbidium complete or almost complete on all laminae .... var. ***curvatus***

1' Limbidium vestigial or absent on dorsal and apical laminae .... var. ***inclinabilis***

Fissidens curvatus Hornsch. var. ***curvatus***

ILLUSTRATIONS: G.O.K.Sainsbury, *A handbook of the New Zealand mosses*. 46, Pl. 6, Fig.3 (1955 – as *F. pungens*); G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia*, 85, Pl. 7; 87, Pl. 8; 89. Pl. 9, (1976 – as *F. pungens*); D.G.Catcheside, *Mosses of South Australia*, 71, Fig. 11 (1980 – as *F. pungens*). Z.Iwatsuki, *J. Hattori Bot. Lab.* 48: 181, Fig. 5 (1980 – as *F. strictulum*). (**Fig. 4**)

Plants small, 2–5(–10) mm tall, usually dimorphic. **Sterile stems** with 8–12 pairs of leaves, ± uniform. **Leaves** oblong-lanceolate or linear-lanceolate, (0.5–)0.75–1.50(–2.0) mm long, 0.15–0.30(–0.5) mm wide; **limbidium** strong, 2–4 stratose, usually confluent with the excurrent costa; **apex** acute, acuminate; **vaginant laminae** $^{1}/_{2}$–$^{3}/_{4}$ leaf length, closed; **dorsal lamina** tapered to the base; **margins** entire; **laminal cells** pellucid, firm- or thin-walled, ±hexagonal, 8–10 µm long, longer proximally.

Male plants gemmiferous, rhizautoicous or axillary at the base, occasionally separate. **Fertile stems** short or long; leaves in 2–10 pairs. **Perichaetial leaves** with vaginant laminae ±open. **Setae** to 5 mm long. **Capsules** ovate, asymmetrical, inclined, to *c.* 1.0 mm long, rarely subsymmetrical and erect. **Operculum** conical-rostrate, 0.40–0.55 mm long. **Calyptra** 0.40–0.55 mm long. **Spores** 9–15 µm in diameter.

Widespread in all Australian States and Territories. Norfolk Island.

Also in southern U.S.A., Mexico, South America, Europe, South Africa, India,

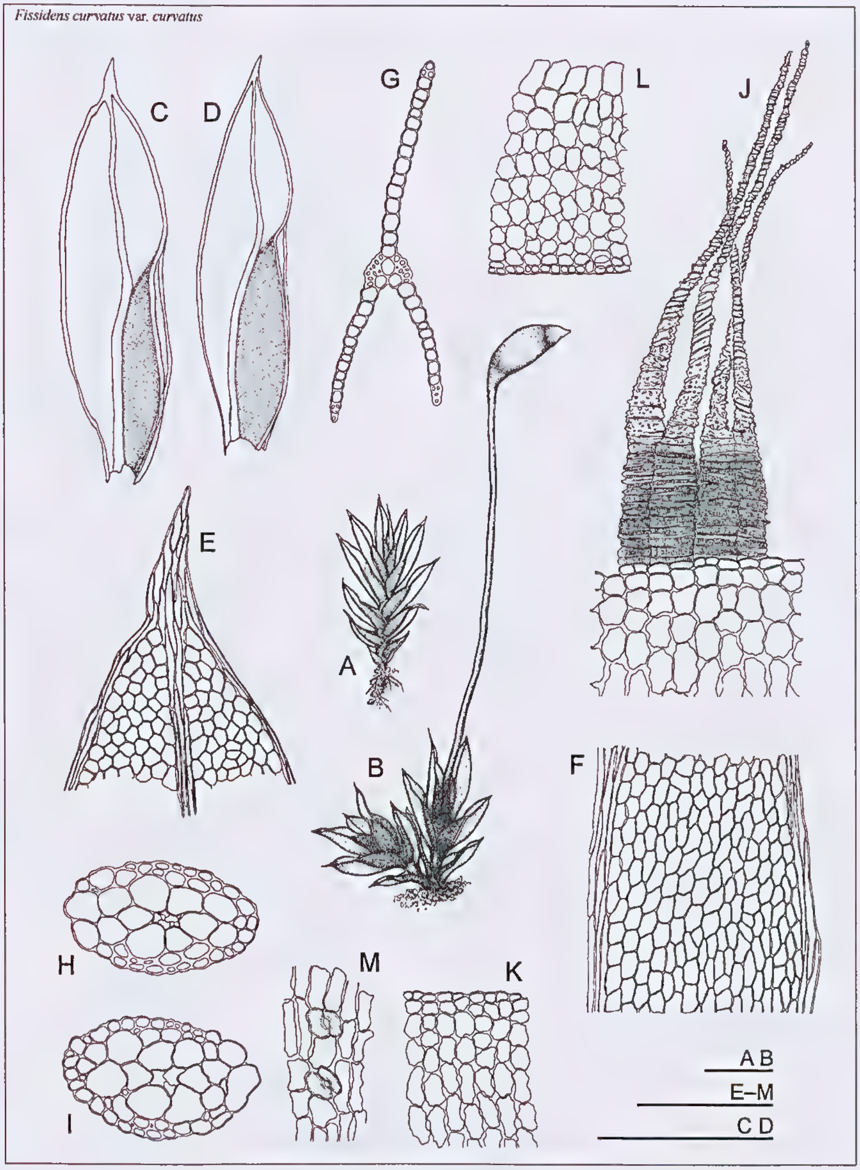

Fig. 4. ***Fissidens curvatus*** Hornsch. var. ***curvatus***.
Drawn from: Tasmania: Blue Tier, State Forest, *T.Thekathyll s.n.*, (HO 560181).

A, B. Plants; **C, D.** Stem leaves; **E.** Cells of leaf apex; **F.** Mid lamina cells of dorsal lamina; **G.** Section of leaf through dorsal and vaginant laminae. **H, I.** Stem sections; **J.** Peristome teeth; **K.** Exothecial cells near capsule mouth; **L.** Cells at base of operculum; **M.** Stomata from capsule neck.

Scales: = 1.0 mm (A, B); = 0.5 mm (C, D); = 100 µm (E–M).

China, Japan, New Caledonia, New Zealand (including Auckland Islands, Campbell Island).

Grows on soil and rocks.

SELECTED SPECIMENS EXAMINED: Tasmania: Marakoopa Cave area, *I.G.Stone 25201* (MEL); Fern Tree, beside Browns River, *L.H.Cave 1885* (HO 572727); Blue Tier, State Forest, *T.Thekathyil 1710* (HO 560181); Maria island, *L.Rodway*, Apr. 1912 (HO 73506); Mt. Field, Lady Barron Falls, *A.Moscal 23594* (HO 300489); Marakoopa Creek, Marakoopa State Reserve, *A.Moscal 24374* (HO 300490); West Coast, Webb's Creek, *A.Moscal 21694* (HO133986).

Typical *F. curvatus* is usually dimorphic, the sterile stems having smaller, more numerous, ±uniform leaves. Fertile stems are shorter with terminal subperichaetial and perichaetial leaves much larger that the lower, ±uniform leaves. The synonyms cited above are mostly longer plants than the typical form, usually fertile, and they do not always exhibit dimorphism. The limbidium can be absent from some leaf apices and, particularly in barren plants, it can be very imperfect.

Fissidens curvatus Hornsch. var. ***inclinabilis*** (Müll.Hal. *ex* Dixon) J.E.Beever, *The Bryologist* 98: 315 (1995)

ILLUSTRATIONS: J.E.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key* 26 (2002). **(Fig. 5)**

Sterile shoots to 8 mm tall. **Leaves** lax, in 12–15 pairs, the largest in mid-stem; linear-lanceolate, 0.5–1.0 mm long, 0.15–0.20 mm wide; **apex** acute; **costa** strong, subpercurrent to percurrent; **vaginant laminae** *c.* 1/4 leaf length, *c.* 1/2 open; **limbidium** 4–5 seriate below, cells of outer row rectangular, broader and shorter; **dorsal lamina** broad above, narrowed below, ceasing above the base to slightly decurrent; limbidium absent or vestigial; **lamina cells** thin-walled, ±quadrate to hexagonal, *c.* 1–12 µm long, 6–10 µm wide, rectangular basally in vaginant laminae and 12–25 µm long, 8–10 µm wide.

Fertile plants with 4–8 pairs of leaves; **leaves** lanceolate. **Perichaetial leaves** to 1.4 mm long, 0.3 mm wide; **limbidium** intermittent on dorsal lamina; **costa** short excurrent; **vaginant laminae** broad, open; **limbidium** conspicuous; **dorsal lamina** failing just above the leaf base, with a vestigial limbidium. **Setae** 2–5 mm long. **Capsules** oblong, asymmetrical, ±horizontal, theca *c.* 0.6 mm long, 0.4 mm wide. **Operculum** conical, with an erect rostrum, *c.* 0.5 mm long. **Spores** 15–17.5 µm in diameter.

In Australia, occurs in W.A., A.C.T., Vic., Tas.

Also known in New Zealand.

SELECTED SPECIMENS EXAMINED: Tasmania: Domain, Hobart, *L.Rodway*, Aug. 1911 (HO 73545); Top of Forest Road, Hobart, *W.A.Weymouth*, 11 Aug. 1888 (HO 73538); Bruny Island, Ford's Bay, *L.Rodway*, June 1914 (HO 73461); West Tamar, near Exeter, *W.A.Weymouth 1134* (HO 73535); Bates Creek, Woodbridge, 9 Nov. 1889, *W.A.Weymouth* (HO 73494).

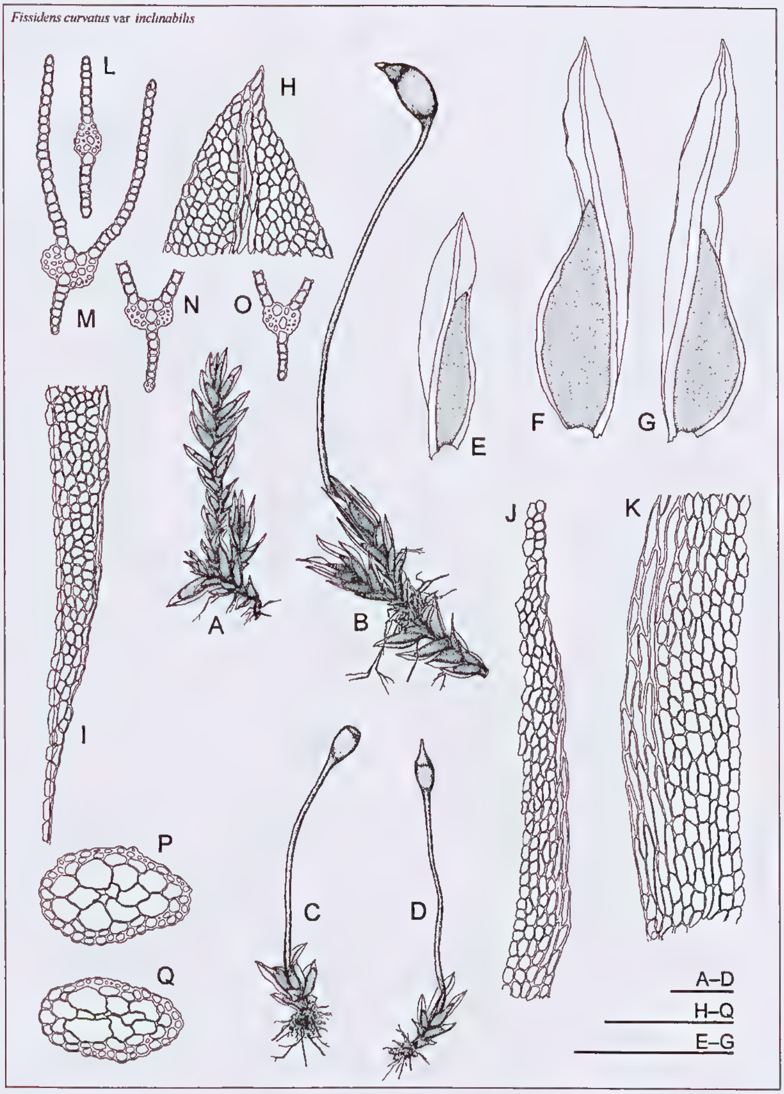

Fig. 5. ***Fissidens curvatus*** Hornsch. var. ***inclinabilis*** (Müll.Hal *ex* Dixon) J.E.Beever.
Drawn from: Tasmania: Weldborough, *G.Murphy s.n.*, (Figs. a, b, e–q); and Western Australia: north of Pemberton, *I.G.Stone 23598* (MEL 2331523 – figs c, d).

A, B. Female plant; **C, D.** Female plants with sporophytes; **E.** Stem leaf; **F, G.** Perichaetial leaves; **H.** Cells of leaf apex; **I.** Cells of proximal part of dorsal lamina of stem leaf; **J.** Cells of proximal part of dorsal lamina of perichaetial leaf; **K.** Cells of proximal part of vaginant lamina of stem leaf; **L.** Section of leaf through apical lamina; **M–O.** Section of leaf through vaginant and dorsal laminae; **P, Q.** Stem sections.

Scales: = 1.0 mm (A–D); = 0.5 mm (E–G); = 100 μm (H–Q).

Small sterile plants having a vestigial or obsolete limbidium can be difficult to distinguish from *F. taylorii*. Fertile plants are readily recognisable by the intermittent limbidium on the dorsal laminae and the asymmetrical capsules.

Fissidens dealbatus Hook.f. & Wilson *Fl. Nov.-Zel.* 2: 63. 84 f. 2. 1854.

TYPE: New Zealand: Bay of Islands, *J.D.Hooker W.318*; Holotype: BM.

Fissidens splachnoides Broth., Öfvers. *Förh. Finska Vetensk.-Soc.* 35: 37, (1893). Type: Australia: Queensland; Brisbane, *F.M.Bailey 256*. Isotype: NY 01025936 conf. I.G.Stone) *fide* R.D.Seppelt, *Kanunnah* 7: 72 (2014)

ILLUSTRATIONS: I.G.Stone, *J. Bryol.* 14: 321, fig. 2 (as *F. splachnoides*), 322, fig. 3 (1985b); J.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key* 28 (2002); D.Meagher & B.Fuhrer, *A Field Guide to the Mosses and Allied Plants of Southern Australia* 39 (2003). **(Fig. 6)**

Plants 4.0–8.0 mm long, pale grey-green to dark green, delicate, loosely gregarious or scattered. **Stems** simple, pale, fleshy, with basal rhizoids only; in section, all cells thin-walled, outer layers not differentiated; lacking a central strand. **Leaves** in 2–8 pairs, upper leaves much larger than lower leaves, not overlapping in mid-stem; when moist, ±falcate, erect-spreading, loosely crisped when dry; lanceolate to ovate-lanceolate, 1.5–2.5 mm long, 0.4–0.6 mm wide; **apex** acute; laminae unistratose, limbate; **limbidium** 1–2(–3) cells wide, 2–5 cells thick, the cells very narrow, elongate, thick-walled, forming a well-defined border on all laminae; **vaginant lamina** $^1/_2$–$^2/_3$ leaf length, almost closed to closed, apex acute; **dorsal lamina** reaching the leaf base; **margins** entire, occasionally weakly crenulate or weakly dentate near leaf apex; **laminal cells** irregularly hexagonal, lax, thin-walled, (30–)40–80(–90) µm long, 20–30(–45) µm wide; **costa** absent but junction of laminae several cells thick in section.

Autoicous or **dioicous**. **Perigonia** terminal on male branches at base of female plants or on separate male plants smaller than female; leaves in 4–7 pairs. **Perichaetia** terminal; **perichaetial leaves** not differentiated from vegetative leaves. **Setae** colourless to pale yellow, 1.5–5.0 mm long, fleshy, ±fragile. **Capsules** erect, symmetric, 0.5–0.8 mm long, 0.3–0.6 mm wide; **exothecial cells** 20–40 µm long, 10–13 µm wide, in *c.* 50–60 columns around the periphery, thin-walled, collenchymatous; **operculum** rostellate to rostrate, 0.2–0.5 mm long; **peristome** of *scarious*-type, 30–55 µm wide at base, *c.* 250 µm long. **Calyptra** 0.2–0.5 mm long, narrow conical, covering the capsule, mitriform, flared at base. **Spores** 10–13(–17) µm in diameter, greenish, very finely papillose.

In Australia, occurs in W.A., Vic. and Tas.

Also known in New Caledonia, Vanuatu, Fiji, Samoa and New Zealand.

Grows on soil, usually in wet fern gullies.

SELECTED SPECIMENS EXAMINED: Tasmania: Stackhouse Falls, *W.Archer* (NY); West End Rivulet, *W.Archer* (HO 69009 – fertile);

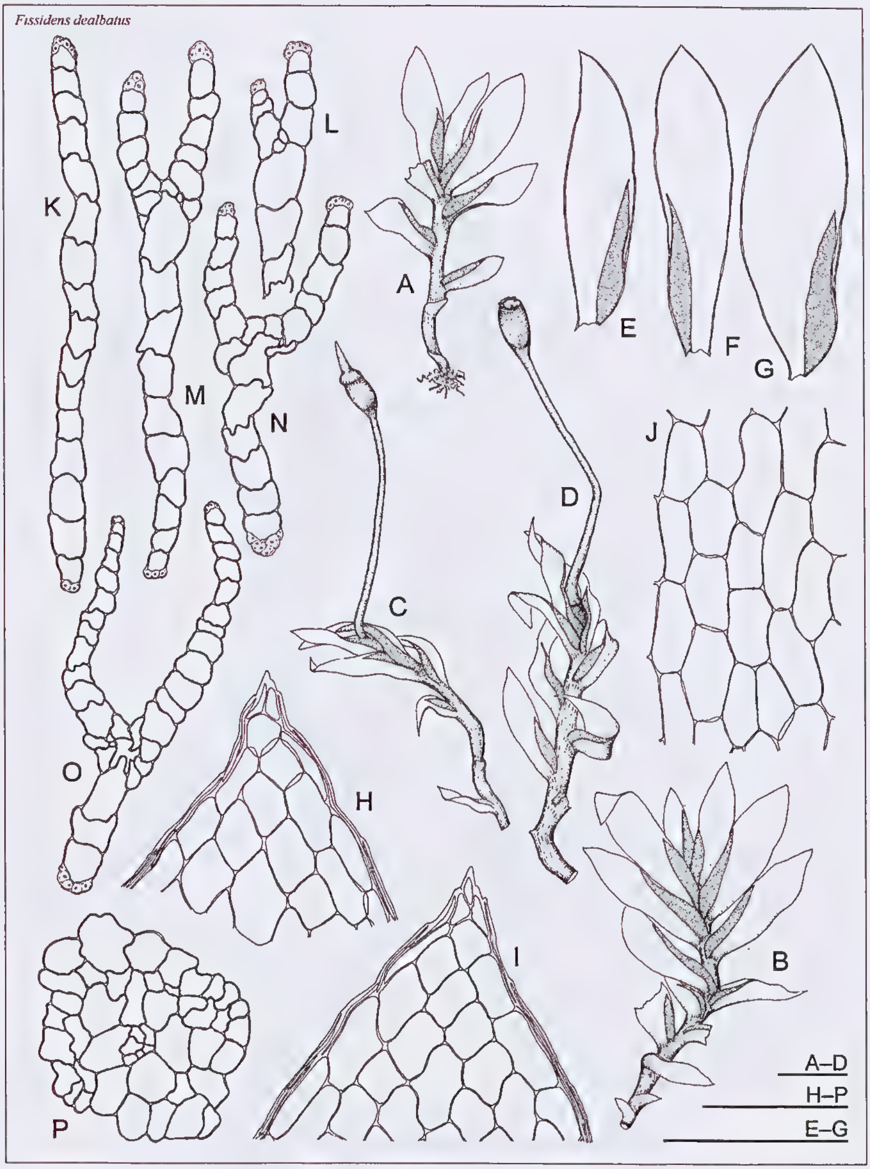

Fig. 6. ***Fissidens dealbatus*** Hook.f. & Wilson *in* Hook.f.
Drawn from *I.G.Stone 9974*, Victoria, Gippsland Plain (MEL 2194807).

A, B. Sterile plants; **C, D.** Plants with sporophytes; **E–G.** Stem leaves; **H, I.** Cells of leaf apex; **J.** Leaf mid lamina cells; **K.** Section of leaf apical lamina; **L–O.** Sections of leaves showing vaginant and dorsal laminae, limbidium and cellular proliferation at junction of laminae; **P.** Stem section.

SCALES: = 1.0 MM (A–D); = 1.0 MM (E–G); = 100 μM (H–P).

Upper Browns R., *A.V.Ratkowsky H.210* (HO 67552); Gully below Fern Tree, *L.Rodway*, May 1912 (HO 75573); St, Mary's Pass, *W.A.Weymouth 2658* (HO 75572); Forth River, near Sheffield, *L.Rodway*, Dec. 1911 (HO 75540). Victoria: Gippsland Plain, *I.G.Stone 9974*, (MEL 2194807).

Stone (1985b) included three taxa from the fomer subgenus *Aneuron* which she considered as distinct: *F. splachnoides* Broth., from NSW and southern Qld; *F. nymanii* (M.Fleisch.) Par., from India, South-East Asia and tropical north Queensland; *F. dealbatus* from Vic., Tas., New Zealand, Fiji and New Caledonia. *Fissidens splachnoides* was first reported from Australia from a collection made by F.M.Bailey near Brisbane (Brotherus 1893). Willis (1955) regarded the species as probably synonymous with *F. dealbatus*, a conclusion with which I agree and the formal synonymy is made in Seppelt (2014, *Kanunnah* 7: 72).

Sexuality can be difficult to accurately confirm and in many collections the plants are either sterile or lack sporophytes. While commonly appearing dioicous, in an early collection of *F. dealbatus* from Tasmania ('West End Rivulet', *W. Archer*, HO 69009), the plants appear to be autoicous. A careful dissection of a single plant revealed the presence of two dehisced antheridia amongst about 10 archegonia in a single perichaetium.

Fissidens nymanii was first identified for Australia by Stone (1985a) and collected from Tully Falls, near Ravenshoe, Queensland. Eddy (1988) suggested that *F. nymanii* was "closely related (possibly conspecific) with *F. hyalinus* of more temperate regions." Iwatsuki and Háji Mohamed (1987) reduced *F. nymanii* to synonymy of *F. hyalinus*, a species originally described from eastern North America. Pursell (pers. comm. 02 Aug. 2013) indicated that, while he had seen no specimens, it was possible that *F. dealbatus* may be close to *F. hyalinus*. While there is considerable overlap in morphological parameters, in the absence of sporophytes *F. hyalinus* (including *F. nymanii*) is distinguished from *F. dealbatus* by its narrower and uni-, occasionally bi-stratose limbidium. The limbidium of *F. dealbatus* is narrow but when viewed with a microscope, transverse sections clearly show it is more than 1 or 2 cells thick.

Fissidens integerrimus Mitt. *in* J.D.Hooker, *Fl. Tasman.* 2: 168 (1859)

TYPE: Australia: Tasmania; Cheshunt, *W.Archer*. Holotype: NY. Isotypes: NY, HO, WELT

Fissidens tasmanicus Broth. & Rodway, *Pap. Proc. Roy. Soc. Tasmania* 1915: 104 (1915). Isotype: Australia: Tasmania; Newmans Creek, Tasman Peninsula, on rocks under water, 2 Feb. 1899, *W.A.Weymouth 2563*. (HO 73459).

ILLUSTRATIONS: J.H.Willis, *Victorian Naturalist* 68: 83 (1951); J.E.Beever & I.G.Stone, *New Zealand J. Bot.* 30: 242–245, Figs. 3–5 (1992); J.E.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key*. 36. (2002). (**Fig. 7**)

Plants slender, 5–25 mm long, dark green to blackened, forming dense, smooth mats or loosely gregarious. **Stems** simple

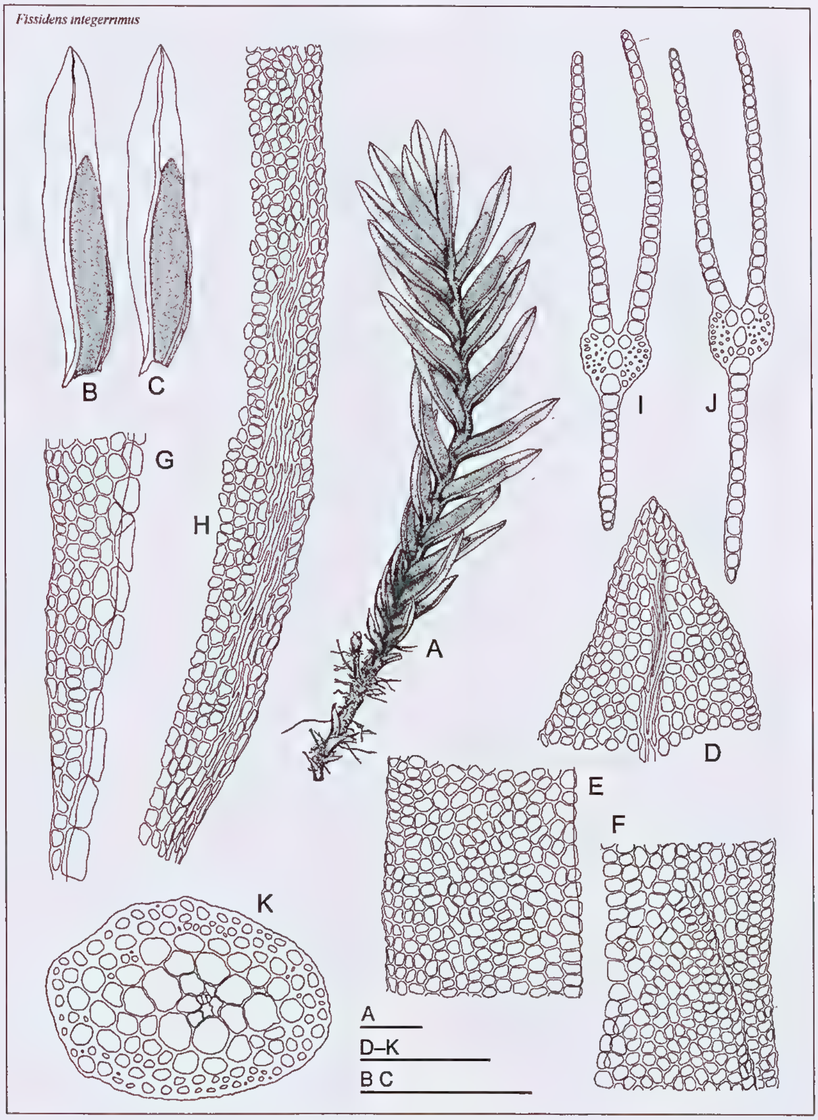

Fig. 7. *Fissidens integerrimus* Mitt.
Drawn from: Tasmania: Newman's Creek, Tasman Peninsula, *W.A.Weymouth 2563* (HO 73458) – Isotype of *Fissidens tasmanicus.*

A. Plant; **B, C.** Stem leaves; **D.** Cells of leaf apex; **E.** Cells of dorsal lamina opposite apex of vaginant laminae; **F.** Cells of apical part of vaginant lamina; **G.** Cells of base of dorsal lamina; **H.** Cells of proximal part of vaginant lamina showing limbidium; **I, J.** Section of leaf through dorsal and vaginant laminae; **K.** Stem section.

SCALES: = 1.0 MM (A); = 0.5 MM (B, C); = 100 μM (D–K).

or branched; axillary nodules weak; in section with a narrow central strand. Rhizoids at base of main stems, branches, or occasionally in leaf axils. **Leaves** oblong-lanceolate, in numerous pairs, 1.0–2.0 mm long, 0.2–0.4 mm wide, erect-spreading to patent; **apex** acute or obtuse, blunt; **margins** weakly serrulate by projecting cells; **laminae** unistratose; **vaginant laminae** reaching $^1/_2$–$^2/_3$ leaf length, open to half closed, **limbidium** usually distinct, sometimes obscure or absent, intramarginal, in 1–3 rows of elongate, vermicular, linear cells; **dorsal lamina** tapered to the leaf base; **lamina cells** thick-walled, subquadrate to hexagonal, smooth, not bulging, 10–15μm wide, the marginal row usually much smaller, becoming larger towards the costa, longer towards the base to 20 μm long; **costa** of *bryoides*-type, subpercurrent.

Dioicous or **autoicous**. **Male plants** separate, shorter, leaves in up to *c.* 9 pairs, or gemmiform and axillary on female shoots; **perigonia** terminal. **Perichaetia** terminal; **perichaetial leaves** narrower than vegetative leaves, to 0.25 mm long. **Setae** 2–3 mm long, terminal on main stem or lateral branches, straw-coloured, stiff. **Capsules** erect to inclined, symmetric, theca 0.6–0.8 mm long, *c.* 0.5 mm wide; **exothecial cells** collenchymatous, in *c.* 30 columns around the circumference; **operculum** rostrate, equalling the theca. **Peristome** of *scariosus*-type, the teeth *c.* 50–60 μm wide at the base, **Calyptra** mitrate, slightly scabrous at the apex. **Spores** 15–20 μm in diameter.

In Australia, occurs in Vic. and Tas.

Also known from New Zealand.

Usually aquatic, on stones in streams, rock crevices in waterfalls.

SELECTED SPECIMENS EXAMINED: Tasmania: Guy Fawkes Rivulet, *W.W.Watts Tas 259* (NSW); Tasman Peninsula, Newmans Creek, *W.A.Weymouth 2563* (HO 73459 – Type of *F. tasmanicus*); Florentine Valley, Growling Swallet, *L.H.Cave 469* (HO 531596); Tarraleah Canal, *H.McFie s.n.* (HO 327808); Tasman Peninsula, *L.Rodway*, Apr. 1916 (HO 73542).

Fissidens integerrimus is frequently blackish with dark greenish tips. It has a similar general appearance and habitat preference to *F. strictus* Hook.f. & Wilson, but in the latter species the leaves lack any trace of a limbidium, the leaf lamina is bistratose, and the leaves are more finely tapered.

Fissidens rigidulus Hook.f. & Wilson is also a common species growing on rock in streams and cascades, but is a much larger plant with the leaves having strong marginal borders several cells thick and the laminae are 1–2(–3) stratose.

Fissidens leptocladus Müll.Hal. *ex* Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1912: 136 (1913)

Fissidens leptocladus Müll.Hal., *Gen. Musc. Frond.* 59 (1901); *F. rigidiusculus* Broth. var. *leptocladus* (Müll.Hal. *ex* Rodway) Broth., *Proc. Linn. Soc. New South Wales* 41: 578 (1916). Type: Australia: Tasmania; Guy Fawkes Rivulet, base of Mt. Wellington, 6 Sept. 1890, *W.A.Weymouth 385*. Lectotype: HO, *fide* I.G.Stone, *J. Bryol.* 16: 262 (1990); Isolectotypes: CANB, L, NY; Tasmania: on face of rock on bank of Guy Fawkes Rivulet, 1 Jan 1897, *W.A.Weymouth 2157*; Paratype: HO. Tasmania: Guy Fawkes Rivulet, on damp bank, 3 Sept. 1906, *W.A.Weymouth 2281*; Paratype: HO.

ILLUSTRATIONS: G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia* 85, Pl. 7; 87, Pl. 8; 89, Pl. 9 (1976); D.G.Catcheside, *Mosses of South Australia* 71, Fig. 12 (1980); J.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key* 38 (2002); H.Streimann, *The Mosses of Norfolk Island* 81, Fig. 35 (2002). (**Fig. 8**)

Plants densely gregarious, yellow-green to dark green. **Stems** 5–20 mm tall, simple or occasionally branched. **Leaves** in numerous pairs, linear-lanceolate, lanceolate or oblong-ovate, ±falcate when moist, patent, often ±undulate, when dry strongly falcate-decurved or secund, often crisped, 1.00–1.75 mm long, 0.25–0.45 mm wide, 2–7 times longer than wide; **apex** acute to narrowly acuminate; **laminae** unistratose; **vaginant laminae** reaching $^1/_2$–$^2/_3$ leaf length, closed; **dorsal lamina** reaching the leaf base or short-decurrent, occasionally bistratose at the base; **limbidium** throughout, except at the leaf apex, rarely confluent with the costa, the cells thick-walled, prosenchymatous, unistratose, narrow, usually widening at the vaginant laminae; **lamina cells** small, firm-walled, concave, dark, quadrate to hexagonal, *c.* 5–9 µm wide; **costa** of *bryoides*-type, subpercurrent to occasionally percurrent.

Dioicous. Male plants short, leaves in 3–7 pairs. **Perigonia** terminal. **Perichaetia** terminal; **perichaetial leaves** to 2 mm long, longer and narrower than vegetative leaves; **limbidium** proximally on vaginant laminae sometimes with an outer row of ±quadrate cells. **Setae** straw-coloured to orange-brown, to 6 mm long. **Capsules** inclined, ±symmetrical, oblong-ovate, *c.* 0.5 mm long, the apophysis ±swollen; **exothecial cells** quadrate to rounded short-rectangular, 20–35 µm long, 15–25 µm wide, collenchymatous, in 45–55 columns around the perimeter at mid capsule. **Operculum** *c.* 0.5 mm long, obliquely rostrate, *c.* half the length of the theca. **Peristome** of *bryoides*-type; teeth *c.* 30–50 µm wide at the base, 160–200 µm long. **Calyptra** cucullate, smooth. **Spores** 10–14(–18) µm in diameter.

In Australia, widespread in all States and Territories, Lord Howe Island, Norfolk Island.

Also known in South America (Chile), New Zealand, Auckland Islands, Campbell Island.

Grows on damp soil or rock in shaded places, occasionally in basalt or limestone caves.

SELECTED SPECIMENS EXAMINED: Tasmania: Truganini Track, near Hobart, *I.G.Stone 25325* (MEL); Julius River Reserve, S of Smithton, *I.G.Stone 25286, 25287, 25288* (MEL); Guy Fawkes Rivulet, *W.A.Weymouth 385* – Lectotype (HO 75597); Croesus Cave State Reserve, *A.Moscal 24519* (HO 133715); Epping Forest Reserve, *A.Moscal 23919*, (HO 300476); King Solomon's Cave State Reserve, 13 km W of Mole Creek, *R.Coveny 17407* (HO 325305); Southport, *L.Rodway,* Apr. 1911 (HO 75587); Flinders Island, Pats River, Palana Road Bridge, *L.H.Cave 2222* (HO 572924 – c.fr.).

Fissidens leptocladus is extremely variable in size and shape of the leaves. The species is also tolerant of a wide range of light intensities. Nomenclatural confusion and implications are discussed by Stone (1990b). It appears to be relatively common on, but not restricted to, calcareous substrates.

Fig. 8. ***Fissidens leptocladus*** Müll.Hal. *ex* Rodway.
Drawn from: Tasmania: Guy Fawkes Rivulet, base of Mt. Wellington, *W.A.Weymouth 385* (HO 75597 – Lectotype).

A, B. Fruiting plants; **C, D.** Stem leaves; **E, F.** Cells of leaf apex; **G.** Cells of dorsal lamina opposite apex of vaginant laminae; **H, I.** Cells of upper part of vaginant laminae; **J.** Cells of basal part of vaginant lamina; **K, L.** Sections of leaf through dorsal and vaginant laminae; **M.** Stem section.

Scales: = 1.0 mm (A, B); = 0.5 mm (C, D); = 100 µm (E–M).

Fissidens megalotis Schimp. *ex* Müll. Hal., *Bot. Zeitung (Berlin)* 16: 154 (1858)

TYPE: South Africa: Gronekloof, Cape of Good Hope, *Breutel*. Holotype: BM.

Fissidens vittatus Hook.f. & Wilson, *Fl. Tasman.* 2: 167 (1859). Type: Australia: Tasmania; Circular Head, *R.Gunn 1697*. Holotype: BM. Isotype: HO. *Fissidens forsythii* Broth., *Proc. Linn. Soc. New South Wales* 41: 576 (1916). Type: Australia: New South Wales; near Barbers Creek, Sept. 1899, *W.Forsyth 566*. Holotype: H–BR. Isotypes: MEL, NSW.

ILLUSTRATIONS: G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia*, 85, Pl. 7; 87, Pl. 8; 89, Pl. 9 (1976 – as *F. vittatus*); D.G.Catcheside, *Mosses of South Australia*, 77, Fig. 17 (1980 – as *F. vittatus*); J.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key*. 44 (2002); D.Meagher & B.Fuhrer, *A field guide to the mosses and allied plants of southern Australia*. 43 (2003). (**Fig. 9**)

Plants dark green, densely gregarious, curled downwards when dry. **Stems** to 8 mm long, occasionally branched; in section with a well-defined central strand; rhizoids basal only. **Leaves** in 5–15 pairs, often somewhat recurved when moist, circinate when dry, broadly oblong-lanceolate, 1.0–1.5 mm long, 0.35–0.50 mm wide; **apex** acute, somewhat retrorse; **limbidium** narrow, uniseriate to biseriate, unistratose to bistratose, often failing near the apex, broader in the vaginant laminae and proximally intramarginal with a broad vitta of laminal cells; **vaginant laminae** very broad, reaching $^{2}/_{3}$–$^{3}/_{4}$ the length of the leaf, open and gaping; **dorsal lamina** tapering to the base, not decurrent; **margins** irregularly serrulate near the apex and occasionally the proximal part of the vaginant laminae, elsewhere entire; **lamina cells** strongly convex, firm-walled, rounded hexagonal to pentagonal, *c.* 6 µm in diameter, smooth to obscurely bipapillose, basally larger and clearer; **costa** of *bryoides*-type, strong, percurrent to excurrent.

Dioicous. **Perichaetia** terminal; **perichaetial leaves** longer than vegetative leaves. **Setae** to *c.* 5 mm long. **Capsules** short-oblong, horizontal, asymmetric, *c.* 1 mm long; **exothecial cells** somewhat irregular in outline, quadrate to short-rectangular to elongate hexagonal, 18–35 µm long, 16–20 µm wide, collenchymatous; **operculum** rostrate, *c.* 0.5 mm long; **peristome** of *bryoides*-type. **Calyptra** not seen. **Spores** green, 20–22 µm in diameter. Widespread in southern Australia, known from W.A., S.A., N.S.W., A.C.T., Vic., Tas.

Also known from southern Africa and New Zealand.

Grows on soil, often in low rainfall areas.

SELECTED SPECIMENS EXAMINED: Tasmania: Strickland, July 1912, *L.Rodway* (HO 73487); Circular Head, *R.Gunn 1697* (HO 73485 – Isotype of *F. vittatus*); Logan Road, E of Evandale, *J.Jarman s.n.*, 4 Oct 1994 (HO 573801); Archers Knob, Asbestos Range National Park, *A.Moscal 23987* (HO 134447); Glenorchy, near Elwick, *W.A.Weymouth 2834* (HO 73490); Mt. Nelson, *L.Rodway*, Sept. 1917 (HO 73486); Pittwater Bluff, *A.Moscal 12982* (HO 102735). Victoria: Talarook, *I.G.Stone 9330*. (MEL 2216515): New

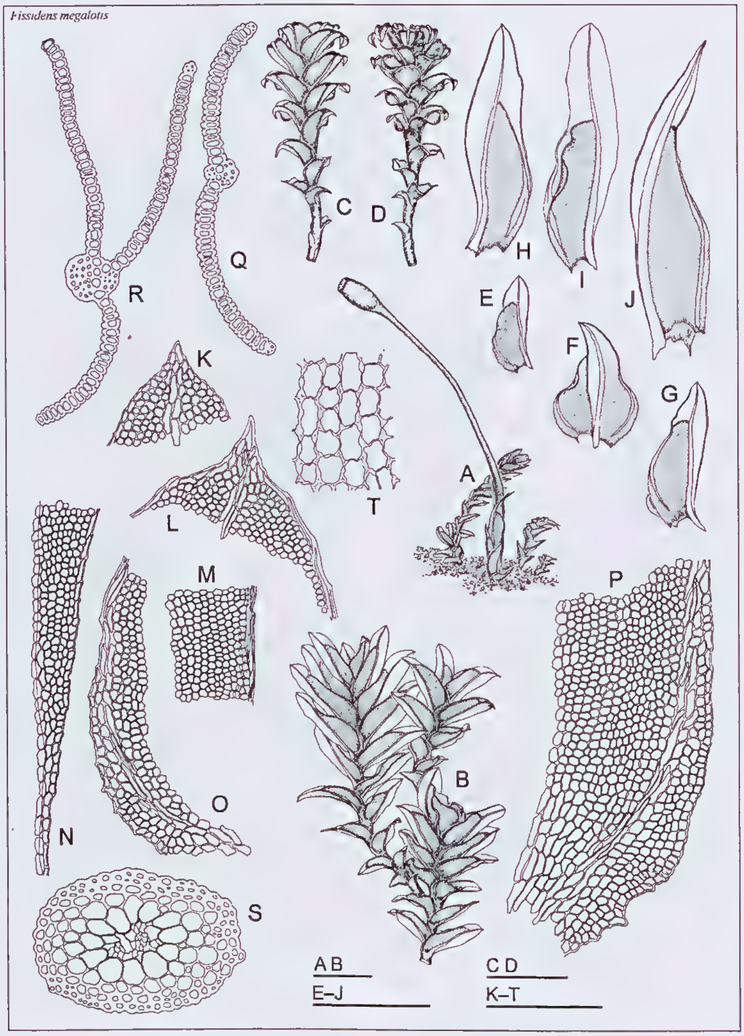

Fig. 9. ***Fissidens megalotis*** Schimp. *ex* Müll.Hal.
Drawn from: Victoria: Talarook, *I.G.Stone 9330.* (MEL 2216515 – Figs a, e–t); Tasmania: Elwick, *W.A.Weymouth 2834.* (HO 73490 – Figs c, d); New South Wales: North of Yass, *I.G.Stone 21684.* (MEL 2261953 – Fig. b).

A. Fruiting plant; **B.** Branched sterile plant; **C.** Shoot tip drawn moist, dorsal side; **D.** Shoot tip drawn from ventral side; **E–G.** Stem leaves, (F) drawn from abaxial side displaying dorsal lamina and broad vaginant laminae; **H–J.** Perichaetial leaves; **K, L.** Cells of leaf apex; **M.** Cells of dorsal lamina opposite apex of vaginant lamina; **N.** Cells of proximal part of dorsal lamina; **O, P.** Cells of proximal part of vaginant lamina showing intramarginal limbidium; **Q.** Section of leaf through apical lamina; **R.** Section of leaf through dorsal and vaginant laminae; **S.** Stem section; **T.** Exothecial cells from mid capsule.

Scales: = 1.0 mm (A, B): = 1.0 mm (C, D); = 1.0 mm (E–J); = 100 µm (K–T).

South Wales: North of Yass, *I.G.Stone 21684*. (MEL).

While *F. megalotis* can have slender, flagelliferous innovations with recurved leaves that resemble those of *F. bifrons* Schimp. *ex* Müll.Hal., the coarsely crenate-dentate margins of the vaginant laminae are diagnostic.

Based on the description and illustrations in Scott & Stone (1976), Magill (1981) stated that it was probable that Australian material (as *F. vittatus*) (= *F. megalotis*) should be included in the synonymy of *F. rufescens* Hornsch. a species otherwise endemic to the eastern and southern parts of Africa. The relationships of these taxa need further investigation.

Fissidens oblongifolius Hook.f. & Wilson, *London J. Bot.* 3: 547 (1844)

TYPE: New Zealand: Bay of Islands, 1839–1843, *J.D.Hooker 321b*. Lectotype: BM, *fide* M.A.Bruggeman-Nannenga, R.A.Pursell & Z.Iwatsuki, *J. Hattori Bot. Lab.* 77: 263 (1994).

Plants dark green, loosely gregarious. **Stems** simple or branched by innovations from below terminal gametoecia, 5–15 mm long; in section with a central strand; rhizoids basal or occasionally from lower leaf axils. **Leaves** in numerous pairs, overlapping in mid-stem, patent, oblong-lanceolate, 1.5–3.0 mm long, 0.2–0.35 mm wide; **apices** acute to obtuse and apiculate, curving away from the substrate when dry; **laminae** unistratose; **margins** crenulated; **vaginant laminae** reaching $^1/_2$–$^3/_4$ leaf length, ending obliquely, closed or nearly so; **dorsal lamina** tapered to the base, often failing above the leaf insertion; **costa** of *oblongifolius*-type, ceasing below the leaf apex.

Autoicous or rarely **dioicous**. **Perigonia** axillary on fertile stems. **Perichaetia** terminal; **perichaetial leaves** longer than stem leaves. **Setae** pale brown, terminal, 2–10 mm long. **Capsule** 0.75–1.40 mm long, horizontal to inclined, moderately to strongly asymmetric; **exothecial cells** quadrate, collenchymatous, 12–25 µm long, 10–15 µm wide; **operculum** long-rostrate, equalling the length of the theca; **peristome** of *similiretis*-type; trabeculae closely spaced on outer basal part with low vertical striae, the forks nodulose and papillose; teeth *c.* 65–90 µm wide at the base. **Calyptra** campanulate, *c.* 1 mm long, covering the operculum. **Spores** small, 8–10 µm in diameter.

Occurs in southern, south-eastern and eastern Australia. Lord Howe Island, Norfolk Island.

Also occurs in New Zealand, New Caledonia, Central and South America, West Africa, Malesia, China, Japan.

Fissidens oblongifolius is usually found on soil and rocks. Iwatsuki & Suzuki (1989) indicate that in New Caledonia the species often occurs also on the base of trees. It is very variable in size of the plants and size of the laminal cells. The capsules are short, but curved and asymmetrical.

The species is characterised by being autoicous, in having the costa usually ceasing a few cells below the leaf apex, strongly mammillose cells, ±asymmetric capsules on a relatively long seta, and the *similiretis*-type peristome.

A pan-Tropical moss with four varieties recognised in Australia, only one of which is known from Tasmania.

Fissidens oblongifolius Hook.f & Wilson, var. ***oblongifolius***

ILLUSTRATIONS: G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia*, 85, Pl. 7; 87, Pl. 8; 89, Pl. 9 (1976); D.G.Catcheside, *Mosses of South Australia*,84, Fig. 23 (1980); J.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key*, 50 (2002); H.Streimann, *The Mosses of Norfolk Island* 85, Fig. 37 (2002). (**Fig. 10**)

Plants dark green. **Stems** 10–15 mm tall, simple or sparingly branched. **Leaves** 2.0–3.5 mm long, 0.65–0.75 mm wide; **apex** acute to obtuse, curved towards the substratum when dry; **vaginant laminae** *c.* $^3/_4$ leaf length, ending obliquely, closed; **margins** ±crenulate; **laminal cells** small, *c.* 8 µm wide, obscure, mammillose.

Autoicous. **Perigonia** axillary on fruiting stems. **Setae** terminal, 5–10 mm long. **Capsule** 1.0–1.4 mm long, gibbous on the back.

In Australia, occurs in S.A., Qld, N.S.W., Vic., Tas. Norfolk Island.

Also occurs in Central and South America, West Africa, Malesia, China, Japan, New Caledonia, northern New Zealand, South Pacific islands.

Usually on rock or on clay banks in moist habitats.

SELECTED SPECIMENS EXAMINED: Tasmania: Guy Fawkes Rivulet, near Hobart, 2 Jan. 1893, *W.A.Weymouth* (HO 75546); Peppermint Bay, *W.A.Weymouth 142*. (HO 73312 – as *F. ligulatus*); Burnie, Fern Glade, *L.H.Cave 893* (HO 555055); Apsley Gorge, *A.Moscal 26443c*, (HO 323032); Point du Ressac, Marion Bay, *A.Moscal 19860* (HO 323030); Guy Fawkes Rivulet, Hobart, *W.A.Weymouth s.n.*, 02 Jan.1893 (HO 73312); Kingston, *A.V.Ratkowsky H687* (HO 67553).

Fissidens pallidus Hook.f. & Wilson, *Fl. Nov.-Zel.* 2: 62 (1854)

TYPE: New Zealand: North Island, *W.Colenso 391, H3750*. Holotype: BM. Isotype: WELT.

Plants persistently pale whitish-green to green, or becoming reddish with age, forming tufts or in gregarious patches. **Stems** 5–40 mm long, with or without fascicles of rhizoids between the vaginant laminae of leaves; in section with a central strand. **Leaves** in numerous pairs, overlapping in mid stem, linear-lanceolate, 1.5–3.0 mm long, 0.30–0.45 mm wide, little altered when dry, except the apex usually circinately revolute; **apex** acute; **margins** entire to slightly serrulate to denticulate near the apex; **laminae** unistratose, **laminal cells** translucent, slightly convex, irregularly rounded-hexagonal, ±isodiametric, 9–25 µm in diameter, marginal cells smaller, 8–10 µm long, 7–9 µm wide, juxtacostal cells of the apical lamina unistratose or bistratose, smooth, medium- to thick-walled; **vaginant laminae** $^1/_2$–$^2/_3$ the leaf length, half closed; **dorsal lamina** tapered to the base, reaching the insertion; **costa** *oblongifolius*-type, narrow, translucent, ending shortly below the apex.

Dioicous. **Perigonia** terminal. **Perichaetia** terminal; **perichaetial leaves** with apical and dorsal laminae narrowed. **Setae** orange-brown, slender, strongly twisted, 3–8 mm long. **Capsule** horizontal, arcuate,

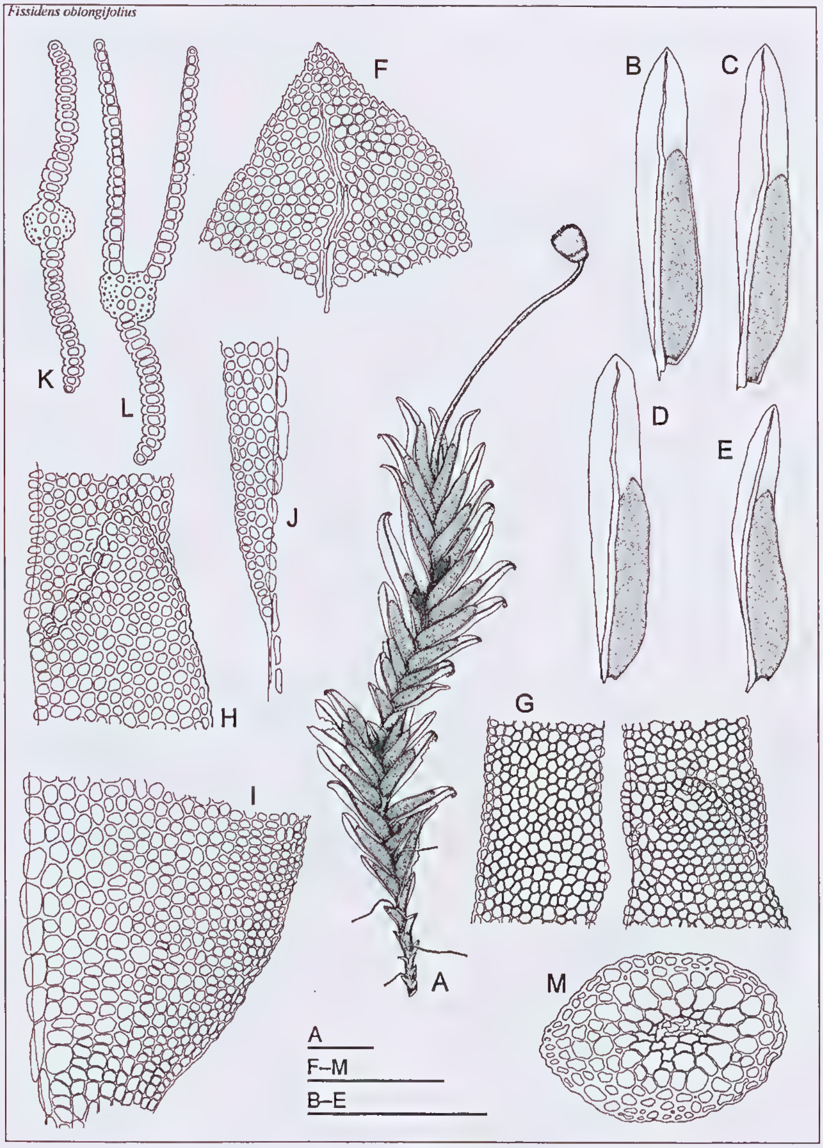

Fig. 10. ***Fissidens oblongifolius*** Hook.f. & Wilson var. ***oblongifolius***.
Drawn from: Tasmania: Peppermint Bay, *W.A.Weymouth 142*. (HO 73312).

A. Plant; **B–E.** Stem leaves; **F.** Cells of leaf apex; **G.** Cells of dorsal lamina and upper part of vaginant laminae; **H.** Cells of upper part of vaginant laminae; **I.** Cells of basal part of vaginant lamina; **J.** Cells of basal part of dorsal lamina; **K.** Section of leaf through apical lamina; **L.** Section of leaf through dorsal and vaginant laminae; **M.** Stem section.

SCALES: = 1.0 MM (A); 1.0 MM (B–E); = 100 μM (F–M).

1.00–1.25 mm long; **exothecial cells** quadrate to hexagonal, moderately thick-walled; **operculum** long-rostrate, equalling the length of the theca. **Peristome** modified *similiretis*-type, with irregularly pitted plates on the dorsal lamellae, trabeculae often well-developed throughout the filaments; teeth 50–80 µm wide at the base, 250–350 µm long. **Calyptra** smooth, mitrate. **Spores** 9–12 µm in diameter.

Occurs in eastern Australia, Lord Howe Island.

Also in Indonesia (Sumatra), Malaysia, Papua New Guinea, New Caledonia. New Zealand.

Two varieties are known from Australia, only one of which is known from Tasmania.

Fissidens pallidus Hook.f. & Wilson var. ***pallidus***

Fissidens whiteleggii Müll.Hal. *ex* Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1912: 135 (1913). Type: Australia: Tasmania; Mt Bischoff, *L.Rodway*; Holotype: HO.

ILLUSTRATIONS: J.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key*, 52 (2002 – as *F. pallidus*); D.Meagher & B.Fuhrer, *A field guide to the mosses and allied plants of southern Australia*. 43 (2003 – as *F. pallidus*). (**Fig. 11**)

Plants persistently pale whitish-green to green, 5–20 mm long. **Stems** with basal rhizoids, lacking fascicles of rhizoids between vaginant laminae. **Leaf margins** entire to slightly serrulate near the apex; **lamina cells** irregularly rounded-hexagonal, 9–15 µm long; juxtacostal cells of apical lamina unistratose.

In Australia, occurs in Qld, N.S.W., Vic., Tas. Lord Howe Island.

Also known in Malesia, New Caledonia, New Zealand.

Common on moist soil banks in rainforest and in hilly and montane areas.

SELECTED SPECIMENS EXAMINED: Tasmania: Mt. Wellington, 13 Nov. 1911, *W.A.Weymouth* (HO 73449); Sandfly Rivulet, *W.A.Weymouth 2316* (HO 73447); Groom River, 3.5km SSE of Lottah, *A.Moscal 26364* (HO 323039); Ringarooma, *L.Rodway s.n.,* Dec. 1920 (HO 73326); Pruana Road, *J.Jarman s.n.,* 29 Jan1992 (HO 310178); Mt Bischoff, *L.Rodway s.n.,* Nov.1892 (HO 73491); Growling Swallet, *J.E.Beever 110–02b* (HO 569140); Wild Wave River, West Coast, *A.Moscal 21122* (HO 323041).

Fissidens rigidulus Hook.f. & Wilson, *F. Nov.-Zel.* 2: 61 (1854)

TYPE: New Zealand: Wellington, 1850, *Lyall 95*; Lectotype: BM, *fide* M.A.Bruggeman-Nannenga, *Proc. Kon. Ned. Akad. Wetensch.,* ser. C, 82: 20 (1979)

ILLUSTRATIONS: M.A.Bruggeman-Nannenga *Proc. Kon. Ned. Akad. Wetensch.,* ser. C, 82: 17, Fig. 4a–g, (1979); D.G.Catcheside, *Mosses of South Australia*,73, Fig. 14 (1980); J.E.Beever & I.G.Stone, *New Zealand J. Bot.* 37: 647, Fig. 2 a–q (1999 – *F. rigidulus* var. *pseudostrictus*); J.E.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key*, 58 (2002); R.D.Seppelt, *The moss flora of Macquarie Island*, 155, Fig. 62, (2004). (**Fig. 12**)

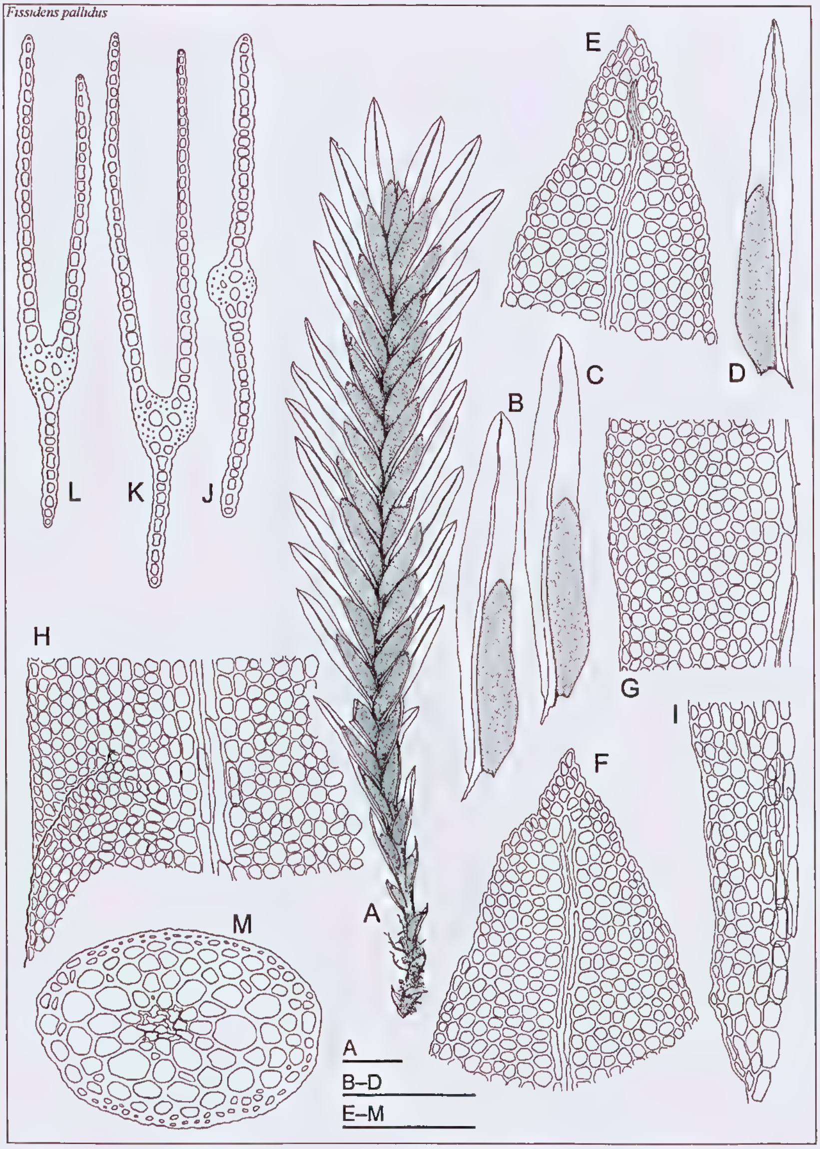

Fig. 11. ***Fissidens pallidus*** Hook.f. & Wilson var. ***pallidus***.
Drawn from: Wild Wave River, West Coast, *A.Moscal 21122* (HO 323041).

A. Plant; **B–D.** Stem leaves; **E, F.** Cells of leaf apex; **G.** Cells of dorsal lamina opposite apex of vaginant laminae; **H.** Cells of upper part of vaginant laminae; **I.** Cells of proximal part of dorsal lamina; **J.** Section of leaf through apical lamina; **K, L.** Sections of leaf through dorsal and vaginant laminae; **M.** Stem section.

Scales: = 1.0 mm (A); = 1.0 mm (B–D); = 100 µm (E–M).

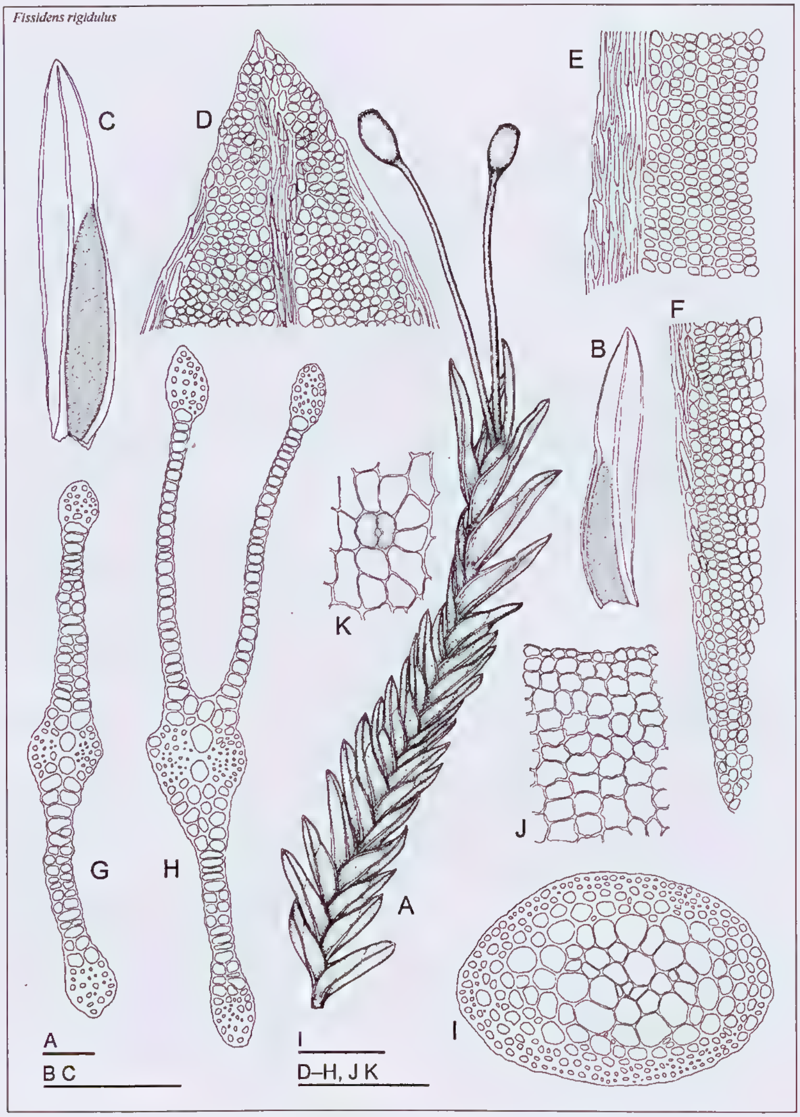

Fig. 12. ***Fissidens rigidulus*** Hook.f. & Wilson.
Drawn from: Tasmania: Between Lake Cethana Lookout and Forth River crossing, *R.D.Seppelt 29481*. (HO).

A. Fruiting stem; **B.** Stem leaf; **C.** Perichaetial leaf; **D.** Cells of leaf apex; **E.** Cells of dorsal lamina and limbidium opposite apical region of vaginant laminae; **F.** Cells of proximal part of dorsal lamina; **G.** Section of leaf through apical lamina; **H.** Section of leaf through dorsal and vaginant laminae; **I.** Stem section; **J.** Exothecial cells; **K.** Stomate from base of theca.

Scales: = 1.0 mm (A); = 1.0 mm (B, C); = 100 μm (D–H, J, K); = 100 μm (L).

Plants robust, stiff, 2–6 cm long, densely gregarious, branched, dark green to blackened. **Stems** stiff; in section with a very narrow central strand. **Leaves** in numerous pairs, rigid, imbricate to distant in part, ±secund when moist, individually curled and twisted when dry, oblong to lanceolate, 2.5–4.0 mm long, 0.6–0.7 mm wide; **limbidium** broad, cartilaginous, yellow, multistratose, complete except at the apex and base of dorsal lamina; **apex** acute to acuminate; **margins** entire; **lamina** 1–3 stratose; **vaginant laminae** closed, reaching *c.* $^{3}/_{5}$ leaf length; **dorsal lamina** tapered to the base, short-decurrent; **laminal cells** small, obscure, ±quadrate to hexagonal, 6–9 µm wide, usually pluristratose juxtacostally, sometimes unistratose. **Costa** modified *bryoides*-type.

Dioicous. **Perichaetia** terminal; **perichaetial leaves** not differentiated. **Setae** straw coloured to brown, 4–8 mm long, 1–2 per perichaetium. **Capsule** ±oblong, *c.* 1 mm long, erect or inclined, slightly asymmetrical; **exothecial cells** quadrate to irregularly rectangular, not thickened at the corners; **operculum** conical-rostrate, *c.* $^{3}/_{4}$ to equal in length to the theca; **peristome** of *bryoides*-type, the teeth 45–55 µm wide at the base. **Calyptra** smooth, cucullate. **Spores** 18–25 µm in diameter.

In Australia, occurs in S.A., Qld, N.S.W., A.C.T., Vic, Tas. Macquarie Island.

Also known in Central America, South America, Falkland Islands, New Guinea, New Caledonia, New Zealand, Auckland Islands, Campbell Island.

Forms dense, dark green mats in aquatic or semi-aquatic habitats, on rocks or earth banks.

SELECTED SPECIMENS EXAMINED: Tasmania: Between Lake Cethana Lookout and Forth River crossing, *R.D.Seppelt 29481* (HO 575167); Lenas Creek, Wardlaw Pass, near St. Marys, 1881, *W.A.Weymouth* (HO 73515, MEL); The Falls, St Crispins, Mt Wellington, *W.A.Weymouth 780* (HO 73525); Gordon Road, 5.8km E of Humboldt Divide, *J.Jarman s.n.*, 25 Oct 2008 (HO 549392); Junee Cave, Maydena, *P.Beveridge FY-30* (HO 553787); German Town, 5km NNE St.Marys, *J.Curnow 2470* (HO 132250); Ben Lomond National Park, *M.G.Noble 28716* (HO 42038); King Island, Grassy River, *I.D.Cameron 55* (HO105717).

Fissidens strictus Hook.f. & Wilson, *Fl. Tasman.* 2: 167 (1859)

TYPE: Australia: Tasmania; York Town Rivulet, *R.Gunn 1610*. Lectotype: BM-Wilson *fide* J.E.Beever, *New Zealand J. Bot.* 33: 291 (1995). Isotype: HO.

ILLUSTRATIONS: J.E.Beever, *New Zealand J. Bot.* 33: 292, Fig. a–w (1995); J.E.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key*, 60 (2002). (**Fig. 13**)

Plants up to 20 mm long, blackish-green except for green shoot tips, forming dense smooth mats or erect tufts on rock in flowing water; glossy blackened when dry. **Stems** rigid, occasionally branched, axillary rhizoids sparse; in section with a narrow central strand. **Leaves** erecto-patent when dry or wet, imbricate, linear, in up to 40 pairs, overlapping in mid-stem; upper leaves *c.* 2 mm long, 0.2–0.3 mm

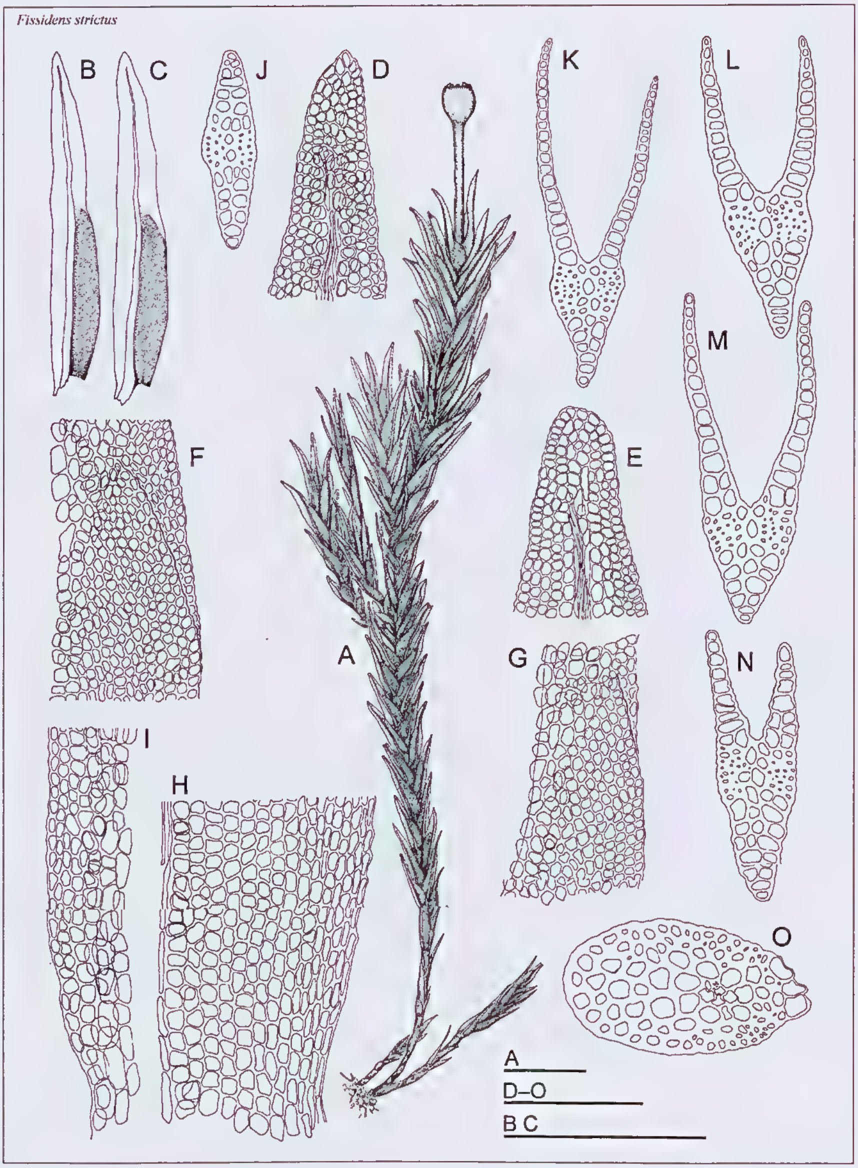

Fig. 13. ***Fissidens strictus*** Hook.f. & Wilson.
Drawn from: Tasmania: York Town Rivulet, *R.Gunn 1610*. (HO 73456 – Isolectotype).

A. Plant; **B, C.** Stem leaves; **D, E.** Cells of leaf apex; **F, G.** Cells of upper part of vaginant laminae; **H.** Cells of proximal part of vaginant lamina; **I.** Cells of proximal part of dorsal lamina; **J.** Section of leaf through apical lamina; **K–N.** Sections of leaf through dorsal and vaginant laminae; **O.** Stem section.

Scales: = 1.0 mm (A); = 1.0 mm (B, C); = 100 µm (D–O).

wide; **apex** acute to narrowly obtuse; **apical and dorsal laminae** bistratose to multi-stratose near the costa, unistratose to the margins; **vaginant laminae** uni- to bi-stratose adjacent to the costa, reaching to *c.* $^1/_2$ leaf length, half open; **dorsal lamina** reaching the leaf base and shortly decurrent on the stem; **margins** minutely crenulated; **lamina cells** ±rounded, irregular, markedly thick-walled, 12–14 µm in diameter, smooth or slightly convex, bistratose to multistratose in the dorsal and apical laminae, except for a broad unistratose border, cells of marginal rows smaller, 6–8 µm in diameter; **costa** of modified *bryoides*-type, yellow or reddish, strong, subpercurrent.

Autoicous. **Perigonia** terminal. **Perichaetia** terminal on main stem or axillary branches; **perichaetial leaves** similar to stem leaves. **Setae** stiff, short, to 2.5 mm long. **Capsule** small, *c.* 0.6 mm long, rounded oblong; **exothecial cells** in 50–70 columns around the circumference; **operculum** conical rostrate, 0.5–0.6 mm long, equalling the theca; **peristome** of modified *scariosus*-type, red; teeth 70–150 µm long, 60–90 µm wide at the base, trabeculae in basal part double and forked, the filaments with oblique thickenings and strongly papillose. **Calyptra** smooth, mitrate. **Spores** brown to green-brown, variable in size, 20–31(–36) µm in diameter; surface very finely and obscurely papillose, appearing smooth.

In Australia occurs in southern Vic. and Tas.

Also known from New Zealand and Auckland Islands. Grows on rock, submerged or in the splash zone in fast flowing oligotrophic waters.

SELECTED SPECIMENS EXAMINED: Tasmania: Hartz Mountains, 17 Feb. 1985, *J.E.Beever 33–75* (HO 89462); Arve Valley, *I.G.Stone 25300* (MEL); York Town Rivulet, Jan. 1843, *R.Gunn 1610* (HO 73456 – isolectotype); Hartz Mountains Road, Arve River. *P.Brownsey s.n.,* 04 Dec. 1988 (HO 117136); Tarraleah Canal, *H.McFie s.n.,* Mar. 1953 (HO 73457); Nelson Waterfall, E of Queenstown, *J.E.Beever 75–32* (HO 301111 – c.fr.).

Beever (1995) provides an account of the species in New Zealand. The modified *scariosus*-type peristome seems anomalous in the revised subgeneric classification of Suzuki & Iwatsuki (2007), where the species is placed in subgenus *Pachyfissidens* section *Pachyfissidens*. Pursell & Bruggeman-Nannenga (2004) place the species in subgenus *Aloma*, based on the *bryoides*-type costa, the modified *scariosus*-type peristome, the smooth lamina cells and unbordered laminae, an allocation followed here, although the number of columns of exothecial cells (*c.* 50) differs from the usual <40 for subgenus *Aloma*. Exceptions to these general rules do occur (Pursell & Bruggeman-Nannenga 2004).

Fissidens taylorii Müll.Hal, *Syn. Musc. Frond.* 1: 65 (1848)

Fissidens pygmaeus Taylor, *London J. Bot.* 5: 66 (1846), *nom. illeg. non F. pygmaeus* Hornsch. (1841). Type: Australia: Western Australia; Swan River, *J.Drummond s.n.*; Holotype: FH. Isotypes: FH, BM.

Plants minute, yellow-green to green, terrestrial, in scattered clusters; shoots

dimorphic, fertile shoots shorter, with a few bract-like leaves subtending perichaetial leaves; rhizoids at base of main shoots and branch shoots. **Vegetative stems** 2–4 mm tall (or more by repeated innovations); in section central strand indistinct or absent. **Stem leaves** erecto-patent, little altered when dry, narrow, oblong to lanceolate, 0.30–0.85 mm long, 0.15–0.20 mm wide, asymmetrical; **apex** obtuse to acute, sometimes apiculate; **laminae** unistratose; **vaginant laminae** $^{2}/_{3}$–$^{4}/_{5}$ leaf length, half open to almost fully closed, elimbate or limbate; **dorsal lamina** narrow, usually failing above the base, elimbate; **margins** entire to minutely serrulate; **marginal cells** of vaginant laminae ±distinct in one to several rows of elongated cells, or undifferentiated; **cells of apical and dorsal laminae** irregularly quadrate to hexagonal, smooth, not bulging, the walls thin to firm. **Costa** in section of *bryoides*-type, subpercurrent to excurrent.

Autoicous or **?dioicous. Perigonia** gemmiform, lateral or basal in leaf axils of sterile or female shoots, occasionally rhizautoicous or apparently independent. **Female shoots** with 2–5 pairs of leaves, usually lateral or basal on sterile shoots, lower leaves bract-like. **Perichaetial leaves** 1.0–1.5 mm long, apical and dorsal laminae narrow, elimbate, dorsal lamina failing above the base, vaginant laminae inflated, usually limbate, occupying most of the leaf, ±open; margins entire to denticulate; costa subpercurrent to excurrent. **Setae** 2–6 mm long. **Capsule** erect to inclined, theca ovoid, ±symmetrical; **operculum** rostellate. **Peristome** of *bryoides*-type with spirally-thickened forks and highly hygroscopic, or of *sainsburia*-type with teeth entire or rimose, not or weakly spirally-thickened and weakly hygroscopic.

Fissidens taylorii is characterised by the distinctly dimorphic sterile and fertile shoots. The fertile shoots, consisting of a few bract-like leaves subtending the perichaetial leaves, are usually axillary, either basal or lateral, but never terminal on an otherwise vegetative leafy stem. The plants can occasionally be dioicous, as male, female and sterile shoots are often independent, although possibly derived by detachment from leaf axils or buried moribund plants.

Detailed descriptions and illustrations are provided in the comprehensive revision by Stone & Beever (1996).

Occurs in all Australian States and Territories.

Also known in North and South America and New Zealand.

Usually on compacted soil, from semi-desert to more moist coastal areas but not in the wet tropics.

Four varieties are known from Australia, with three found in Tasmania.

1 Leaves of sterile shoots broadest above mid-leaf, 2–2.5 times longer than wide; vaginant laminae *c.* 90% or more of leaf length; limbidium generally absent; peristome teeth split, with two spirally thickened arms (not in Tasmania) .... var. ***gillianus***

1' Leaves of sterile shoots usually broadest at or below mid-leaf, 3-4.5 times longer than wide; vaginant laminae *c.* 75% of the leaf length; limbidium present or absent; peristome teeth entire or split 2

2 Peristome teeth entire, rimose or occasionally weakly split, papillose, ±erect whether dry or moist; leaves of sterile shoots subobtuse-apiculate to acute; costa usually percurrent .... var. ***sainsburyanus***

2' Peristome teeth forked, the arms spirally ornamented, recurved when dry, strongly incurved when moist; leaves of sterile shoots obtuse, subobtuse or acute; costa subpercurrent to short-excurrent 3

3 Sterile shoots 2–4 mm tall; leaves 0.30–0.85 mm long; apex obtuse, subobtuse-apiculate to acute; perigonia occasionally separate, often single and axillary at the base of sterile or perichaetial shoots, or numerous and axillary, the leaves then short, obtuse or obtuse-apiculate .... var. ***taylorii***

3' Sterile shoots 5–10 mm tall; leaves 0.5–1.0 mm long; apex acute; perigonia numerous in leaf axils; female shoots 1 or more, axillary near the base .... var. ***epiphytus***

Fissidens taylorii Müll.Hal. var. *taylorii*

Fissidens sarcophyllus Burchard & Broth., *Pap. & Proc. Roy. Soc. Tasmania* 1895: 112 (1896), *nom. nud., F. weymouthii* Paris, *Index Bryol.,* Suppl. 164 (1900), *nom. nud.* Based on: Tasmania: Mt Wellington, *W.A.Weymouth 772,* (HO), *fide* I.G.Stone, *J. Bryol.* 16: 263 (1990).

ILLUSTRATIONS: I.G.Stone & J.E.Beever, *J. Bryol.* 19: 52, Fig. 1; 53, Fig. 2a, c, f; 55, Fig. 4 (1996); J.E.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key,* 68 (2002). (**Fig. 14**)

Vegetative shoots 2–4 mm long, or more by repeated innovations. **Leaves** 0.30–0.85 mm long, 0.10–0.20 mm wide, 3–4.5 times longer than wide; **apex** obtuse to acute, occasionally apiculate; **vaginant laminae** elimbate or weakly limbate. **Laminal cells** thin- or firm-walled, 8–20 µm long, 8–12 µm wide.

Gametoecia mostly axillary on vegetative stems, either basal or lateral, sometimes independent; **perichaetial leaves** with cells of vaginant laminae to 30 µm long, those of the limbidium to 80 µm long. **Setae** 2–6 mm long, erect or flexuose. **Peristome** of *bryoides*-type, teeth recurved when dry, strongly incurved when moist, divided to *c.* half way, the arms spirally thickened, adaxial trabeculae below the bifurcation shallow, scarcely ornamented; teeth 39–60 µm wide at the base. **Calyptra** smooth, cucculate. **Spores** 15–32(–35) µm in diameter.

In Australia Known from W.A., N.T., S.A., Qld, N.S.W., A.C.T., Vic., Tas.

The most widespread and variable variety in Australia, extending from comparatively moist coastal regions into arid Central Australia. Also known from North and South America, New Zealand.

SELECTED SPECIMENS EXAMINED: Tasmania: Proctors Road, Hobart, *W.A.Weymouth 2840* (HO 75561); Mt Lord, *A.Moscal 13038* (HO 323042); Blue Tier, *T.Thekathyil 9* (HO 559198); Guy Fawkes Rivulet, *L.Rodway s.n.,* Oct 1912 (HO 73467); Cradoc, Huon,

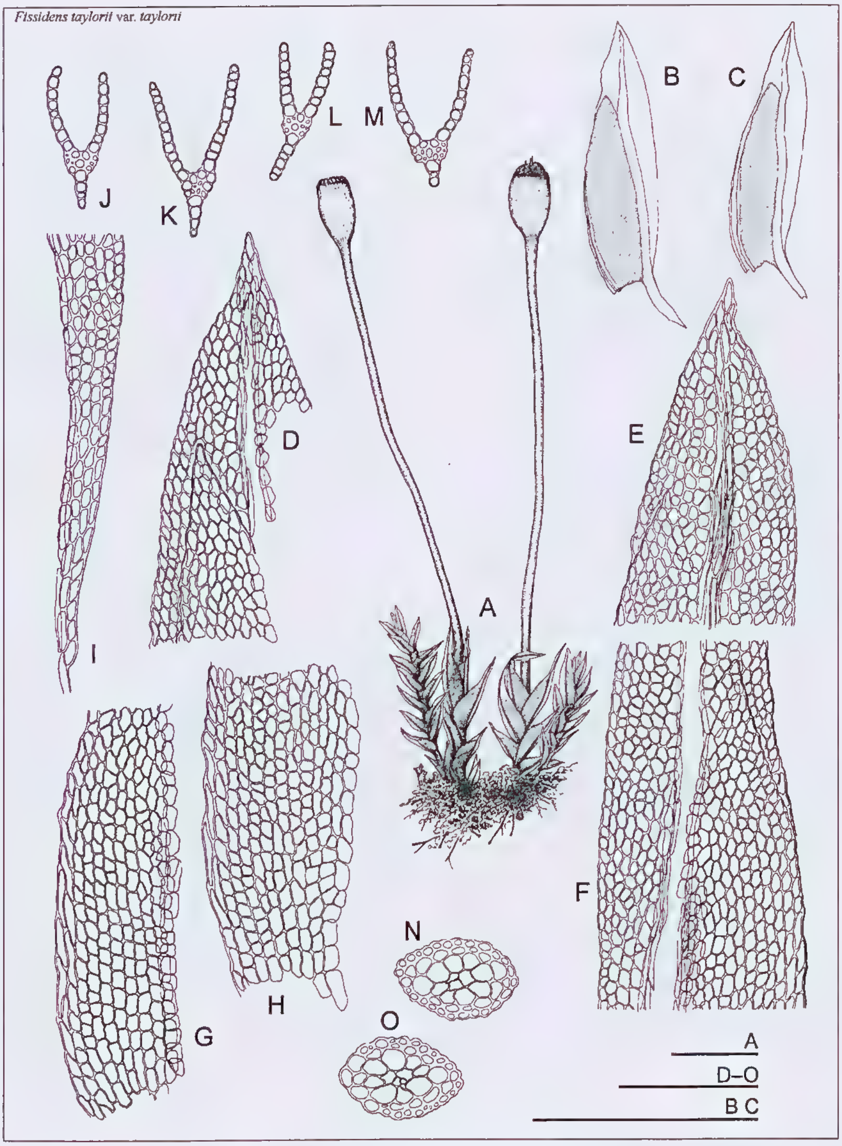

Fig. 14. ***Fissidens taylorii*** Müll.Hal. var. ***taylorii*.**
Drawn from: Tasmania: East Coast, Mt. Lord, *A.Moscal 13038.* (HO 323042).

A. Plants; **B, C.** Stem leaves; **D, E.** Cells of leaf apex and upper part of vaginant laminae; **F.** Cells of upper part of dorsal lamina and vaginant laminae; **G, H.** Cells of proximal part of vaginant laminae of stem leaves; **I.** Cells of proximal part of dorsal lamina; **J–M.** Sections of leaf through dorsal and vaginant laminae; **N, O.** Stem sections.

Scales: = 1.0 mm (A); = 0.5 mm (B, C); = 100 µm (D–O).

W.A.Weymouth 211 (HO 75568); Apsley River, 4km WNW of Bicheno, *A.Moscal 19762* (HO124412); Cataract Gorge, Launceston, *A.J.Taylor s.n.,* 21 Aug 1886 (HO 73463) .

Gametoecia frequently grow from old buried stems, often developing rhizoids at their bases and becoming independent plants.

Fissidens taylorii Müll.Hal. var. ***epiphytus*** (Allison) I.G.Stone & J.E.Beever, *J. Bryol.* 19: 57 (1996)

ILLUSTRATIONS: I.G.Stone & J.E.Beever, *J. Bryol.* 19: 56, Fig. 5 j–m; 58, Fig. 6 (1996); J.E.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key,* 64 (2002). (**Fig. 15**)

Sterile shoots to 10 mm long. **Leaves** in 15–25 pairs, patent, oblong-lanceolate, 0.5–1.0 mm long; **apex** acute; **vaginant laminae** usually limbate.

Gametoecia axillary on stems, the male numerous, 0.2–0.3 mm long, the female sparse, usually in lower leaf axils, 0.5–1.5 mm long. **Peristome** as in var. *taylorii.* **Spores** *c.* 36 μm in diameter.

In Australia, rare in Vic. and Tas.

Also known in south-eastern New Zealand.

SELECTED SPECIMENS EXAMINED: Tasmania: Pittwater Bluff, *A.Moscal 12990* (HO102452). Victoria: Mt Eccles, *A.C.Beauglehole 3060* (MEL); Avon River, *F.Mueller 86* (MEL 29158 – as *F. brevifolius* Broth.).

This variety is characterised by having much larger plants, with longer leaves and more numerous axillary perigonia.

The relationships between *F.taylorii* var. *epiphytus* and *F. taylorii* var. *floribundus* require further study and the two may be synonymous.

NOTE: *Fissidens taylorii* Müll.Hal var. *floribundus* (Wilson) Wijk & Margad., *Taxon* 8: 106 (1959); *F. brevifolius* Hook.f. & Wilson var. *floribundus* Wilson, in J.D.Hooker, *Fl. Tasman.* 2: 167 (1859). Type: Australia: Tasmania; New Norfolk, *Oldfield 218*; Holotype: BM (not located).

It is likely that the type of *F. brevifolius* var. *brevifolius* is synonymous with *F. taylorii* var. *epiphytus.* If these prove to represent the same taxon, their correct name would be *F. taylorii* var. *floribundus.*

Fissidens taylorii Müll.Hal. var. ***sainsburyanus*** J.E.Beever http://www.nzflora.info/publications.html *Fissidens taylorii* var. *sainsburiana* Allison, Trans. Roy. Soc. New Zealand 88: 9 (1960).

ILLUSTRATIONS: D.G.Catcheside, *Mosses of South Australia* 74, Fig. 15d–f (1980 – as *F. taylorii*); I.G.Stone & J.E.Beever, *J. Bryol.* 19: 53, Fig. 2 b, d, e, g; 54, Fig. 3 b, d, f; 60, Fig. 7; 61, Fig. 8; 62. Fig. 9 (1996); J.E.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key,* 66 (2002). (**Fig. 16**)

Leaves 0.4–0.7 mm long, 0.15–0.20 mm wide, in 8–12 pairs; **cells** of apical and dorsal laminae (6–)7.5–12(–18) μm long, (7–)7.5–10.0(–12) μm wide; **costa** strong, subpercurrent to percurrent, often excurrent in a cusp. **Perigonia** bud-like, at the basis of sterile or perichaetial

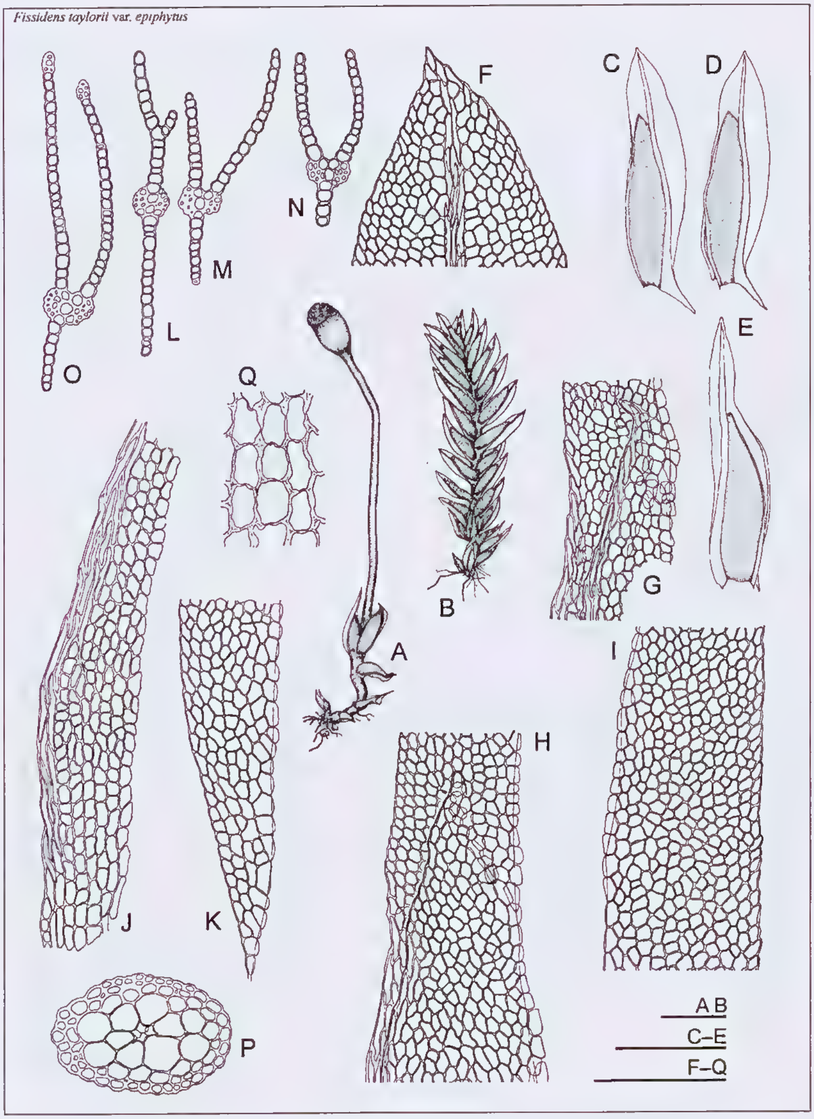

Fig. 15. ***Fissidens taylorii*** Müll.Hal. var. ***epiphytus*** (Allison) I.G.Stone & J.E.Beever. Drawn from: Tasmania: Pittwater Bluff, *A. Moscal 12990* (HO 102452).

A. Fertile shoot with basal perigonial shoot; **B.** Vegetative plant with basal perigynial branch; **C, D.** Stem leaves; **E.** Perichaetial leaf; **F.** Cells of leaf apex; **G, H.** Cells of apical part of vaginant lamina; **I.** Cells of dorsal lamina opposite apex of vaginant lamina; **J.** Cells of base of vaginant lamina; **K.** Cells of base of dorsal lamina; **L–O.** Leaf sections – (L) from near apex of vaginant lamina; **P.** Stem section; **Q.** Exothecial cells from mid capsule.

Scales: = 1.0 mm (A, B); = 0.5 mm (C–E); = 100 µm (F–Q).

shoots. **Perichaetia** terminal on short shoots, axillary at base of sterile shoots or apparently independent; **perichaetial leaves** with vaginant laminae having margins entire or dentate, often elimbate in upper part, widely bordered and entire below, the distal lamina narrowly subulate. **Peristome** inserted well below the capsule rim, of *sainsburia*-type, teeth stiff, erect, undivided or rimose, perforated or entire or weakly forked at the apex, 51–68 µm wide at the base; lamellae finely papillose abaxially at the base, larger above the papillae, often in vertical or oblique rows, adaxially above with longitudinal ridges; tips occasionally faintly spirally thickened. **Calyptra** smooth, cucullate. **Spores** 12–25 µm in diameter.

In Australia, occurs in S.A., N.S.W., Vic., and Tas.

Also known in New Zealand.

SELECTED SPECIMENS EXAMINED: Tasmania: Western Junction, Perth road, 6 Sept. 1888, *W.A.Weymouth* (HO73544); Bellerive, *R.A.Bastow 97* (HO 75563); Kangaroo Point, Lauriston Gully, *W.A.Weymouth 225* (HO 75571); Cascades, *L.Rodway s.n.,* Oct 1921 (HO 75565); Waterworks, near Hobart, *R.A.Bastow 130* (HO 75560).

Similar to var. *taylorii* but apical and dorsal laminae of vegetative leaves often more reduced and the lamina cells slightly smaller. The peristome structure is unique.

Originally described by Dixon (1941) as the monotypic genus *Sainsburia* because of its unique peristome but closely resembling *F. taylorii* gametophytically, it was considered by Sainsbury (1955) as a synonym of *F. taylorii.* Allison (1960) elevated the taxon to varietal status.

The peristome is quite unique in the genus *Fissidens* (Bruggeman-Nannenga & Berendsen 1990). A similar peristome is found in some members of the Grimmiaceae (Edwards 1984, Figs 4d, 7n).

Much emphasis has been placed on peristome structure in the classification of mosses (Philibert 1884; Edwards 1984; Goffinet, Buck & Shaw 2009). As the peristome is unique within the genus, the relationships of *F. taylorii* var. *sainsburyanus* need further elucidation.

Fissidens tenellus Hook.f. & Wilson, *Fl. Nov.-Zel.* 2: 62 (1854)

TYPE: New Zealand: Bay of Islands, 1839–1843, *J.D.Hooker, A.Wilson 320*; Lectotype: BM, *fide* I.G.Stone, *J.Bryol.* 16: 263 (1990); New Zealand: North Island; Thompson's Sound, 1850, *Dr. Lyall 220*; Syntype: BM; New Zealand: Auckland, *Sinclair,* BM.

Plants yellow-green to dark green, loose to densely gregarious, flabellate, 1–3(–5) mm long. **Stems** simple or occasionally branched; in section with a narrow central strand of few thin-walled cells; axillary hyaline nodules present; rhizoids arising from base of stems and branches. **Leaves** in 4–6 pairs, linear-lanceolate, overlapping in mid-stem, slightly falcate when moist, little altered when dry, patent, 0.75–1.25 mm long, 0.15–0.20 mm wide; **apex** broadly to sharply acute or acuminate; **laminae** unistratose; **vaginant laminae** $^2/_5$–$^1/_2$ leaf length, usually partly open; **dorsal lamina** tapered to the base, failing above or reaching the insertion; **lamina cells** pellucid,

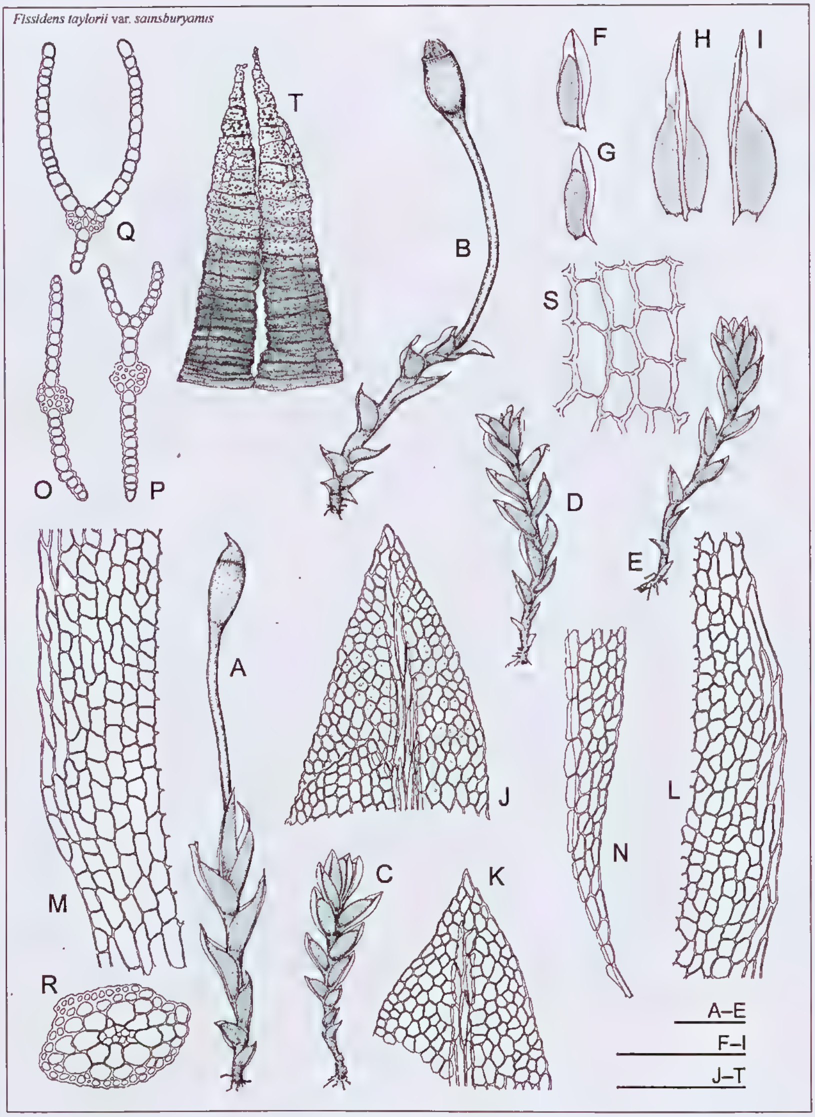

Fig. 16. *Fissidens taylorii* Müll.Hal. var. ***sainsburyanus*** J.E.Beever.
Drawn from: Tasmania: Western Junction, Perth Road, *W.A. Weymouth*, 06 Sept. 1888 (HO 73544).

A, B. Fertile plants; **C–E.** Vegetative plants; **F, G.** Stem leaves; **H, I.** Perichaetial leaves; **J, K.** Cells of leaf apex; **L.** Cells of margin of vaginant lamina at mid leaf; **M.** Cells of basal part of vaginant lamina; **N.** Cells of base of dorsal lamina; **O.** Section of leaf through apical lamina; **P, Q.** Sections of leaf through dorsal and vaginant laminae – (P) from near apex of vaginant lamina; **R.** Stem section; **S.** Exothecial cells from mid capsule; **T.** Peristome teeth.

Scales: = 1.0 mm (A–E); = 1.0 mm (F–I); = 100 µm (J–T).

variably convex, irregularly quadrate to hexagonal, 8–12 µm in diameter, sharply unipapillose or strongly mammillose; cells of the vaginant laminae usually longer, rectangular, basally to 30 µm long; **costa** of *bryoides*-type, subpercurrent to percurrent, occasionally excurrent.

Autoicous, rhizautoicous or **dioicous**. **Perigonia** terminal, on short shoots at the base of female shoots or on separate bulbiform or taller plants. **Perichaetia** terminal; **perichaetial leaves** 1.3–2.5 mm long, longer than vegetative leaves; vaginant laminae with proximal cells elongate-rectangular, occasionally intra-marginally prosenchymatous; margins irregularly toothed. **Setae** light brown, 2–5(–10) mm long. **Capsule** erect, symmetric, narrowly oblong, 0.4–0.7 mm long; **exothecial cells** quadrate to short rectangular, collenchymatous, in 32–40 columns around the circumference; **operculum** rostrate, ±equal in length to the theca. **Peristome** of *scariosus*-type. **Calyptra** mitriform, usually papillose. **Spores** 7.5–14.0 µm in diameter.

Occurs in south-western, south-eastern and eastern Australia. Lord Howe Island, Norfolk Island.

Also known in New Zealand, Auckland Islands, New Caledonia, Chile, La Réunion.

Grows on rock, soil, peat, humus, or as an epiphyte.

Two varieties are recognised in Australia, both occur in Tasmania:

1 Usually growing on rock, occasionally on soil; leaves usually more than 5 times longer than wide; costa percurrent, occasionally excurrent; setae 2–5(–10) mm long .... var. ***tenellus***

1' Usually growing on bark, occasionally on peat or humus; leaves usually less than 5 times as long as wide; costa ending 2–4 cells below the apex; setae 2–3 mm long .... var. ***australiensis***

Fissidens tenellus Hook.f. & Wilson var. ***tenellus***

ILLUSTRATIONS: G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia* 85, Pl. 7; 87, Pl. 8; 89, Pl. 9 (1976 – as *F. tenellus*); D.G.Catcheside, *Mosses of South Australia*, 81, Fig. 20 (1980 – as *F. tenellus*); I.G.Stone, *J. Bryol.* 18: 171, Fig. 1; 172, Fig. 2 i–m (1994 – as *F. tenellus*); J.E.Beever & I.G.Stone, *New Zealand J. Bot.* 37: 655, Fig. 6 a–m (1999 – as *F. tenellus*); J.E.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key*, 72 (2002); H.Streimann, *The Mosses of Norfolk Island* 90, Fig. 40 (2002 – as *F. tenellus*); D.Meagher & B.Fuhrer, *A field guide to the mosses and allied plants of Southern Australia* 43 (2003 – as *F. tenellus*); (**Fig. 17**)

Plants 1–5 mm long, occasionally branched. **Leaves** linear-lanceolate, usually more than 5 times longer than wide; **apex** acute to acuminate; **vaginant laminae** half open to open; **margins** crenulate to denticulate on apical and dorsal laminae, irregularly denticulate on vaginant laminae; **costa** percurrent, occasionally excurrent, or failing just below the apex.

Rhizautoicous. **Setae** 2–5(–10) mm long. **Peristome teeth** 33–45 µm wide at the base. **Spores** 7.5–12.0 µm in diameter.

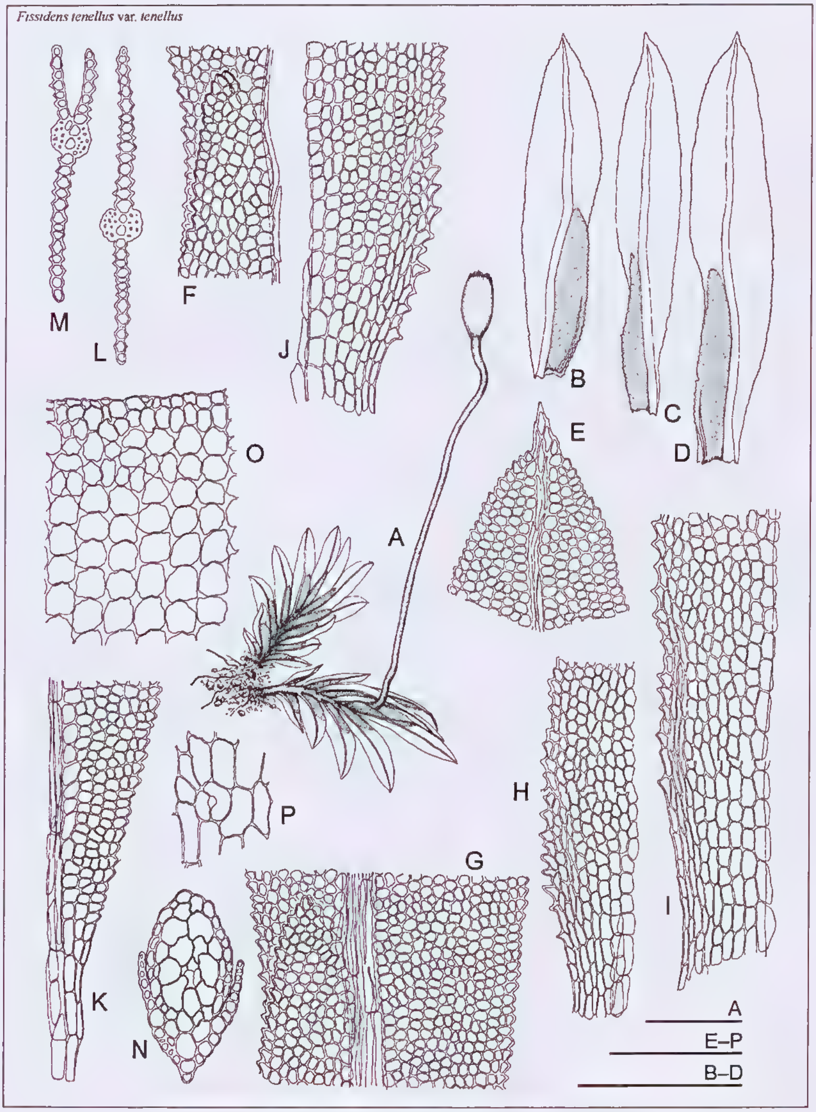

Fig. 17. ***Fissidens tenellus*** **Hook.f. & Wilson var.** ***tenellus*****.**
Drawn from: Tasmania: Growling Swallet, *J.E.Beever 110–11b* (HO 569488).

A. Plant; **B, C.** Stem leaves; **D.** Perichaetial leaf; **E.** Cells of leaf apex; **F.** Cells of upper part of vaginant laminae; **G.** Cells of upper part of vaginant laminae and dorsal lamina; **H–J.** Cells of proximal part of vaginant laminae; **K.** Cells of proximal part of dorsal lamina; **L.** Section of leaf through apical lamina; **M.** Section of leaf through dorsal and vaginant laminae; **N.** Stem section; **O.** Exothecial cells; **P.** Stomate from base of theca.

Scales: = 1.0 mm (A); = 0.5 mm (B–D); = 100 µm (E–P).

In Australia, occurs in W.A., S.A., Qld, N.S.W., Vic., Tas. Lord Howe Island, Norfolk Island.

Also known in New Zealand, Auckland Islands, Campbell Island, New Caledonia, Chile, La Réunion.

Usually on rock, occasionally on soil.

SELECTED SPECIMENS EXAMINED: Tasmania: Sandstone Hill, *W.Archer* (HO 73478); Growling Swallet, *J.E.Beever 110–11b* (HO 569488); Anthony Road, *J.Jarman s.n.*15 Nov 1992 (HO 547770); Mt Wellington, *L.Rodway s.n.,* Jan 1911 (HO 73473); Blackman Rivulet, Forestier Peninsula, *A.Moscal 16971* (HO 323044); Douglas River, *A.Moscal 19554*, (HO 300502); Lenah Valley, *A.V.Ratkowsky H694* (HO 302831).

There is variability in the leaf apex, degree of serration of the lamina margins and in the development of the intramarginal border of the vaginant laminae.

Fissidens tenellus Hook.f. & Wilson var. ***australiensis*** (A.Jaeger) J.E.Beever & I.G.Stone, *New Zealand J. Bot.* 37: 651 (1999)

ILLUSTRATIONS: I.G.Stone, *J. Bryol.* 18: 172, Fig. 2 a–h (1994 – as *F. australiensis*); J.E.Beever & I.G.Stone, *New Zealand J. Bot.*37: 654, Fig. 6 n–s (1999); J.E.Beever, B.Malcolm & N.Malcolm, *The moss genus* Fissidens *in New Zealand: an illustrated key,* 70 (2002). (**Fig. 18**)

Plants 1–3 mm long. **Stems** simple or occasionally branched; hyaline axillary nodules small. **Leaves** lanceolate, less than 5 times as long as wide; **apex** acute; **vaginant laminae** often open; **dorsal lamina** broadly tapered to the base; **lamina cells** rounded, 8–10 µm long, 6–10 µm wide, strongly mammillose, not noticeably larger in vaginant laminae; **costa** ending 2–4 cells below the leaf apex.

Dioicous or **monoicous (rhizautoicous)**. **Perichaetial leaves** with distal part of the vaginant laminae regularly denticulate. **Setae** 2–3 mm long. **Peristome teeth** 25–35 µm wide at the base. **Calyptra** smooth to slightly scabrous, cucullate. **Spores** 7.5–14.0 µm in diameter.

In Australia, occurs in W.A., S.A., Qld, N.S.W., Vic., Tas.

Also known in New Zealand, New Caledonia.

Usually growing as an epiphyte, or growing on humus or peaty soils.

SELECTED SPECIMENS EXAMINED: Tasmania: Guy Fawkes Rivulet, near Hobart, *L.Rodway s.n.*, Aug. 1912 (HO 73476); SE end of Safety Cove, Port Arthur, *P.Brownsey*, Dec. 1988, (HO 117034).

Differs from var. *tenellus* in the shorter vegetative leaves, subpercurrent costa, and more markedly mammillose laminal cells. Although intermediate forms with var. *tenellus* occur, the var. *australiensis* is usually easily recognised by its habitat preference (the former growing on rock and soil, the latter on humus or peaty soils), broader leaf apices, the costa ceasing a few cells below the apex, more even serrations on the vaginant lamina margins, longer setae, narrower peristome teeth, and slightly larger spores.

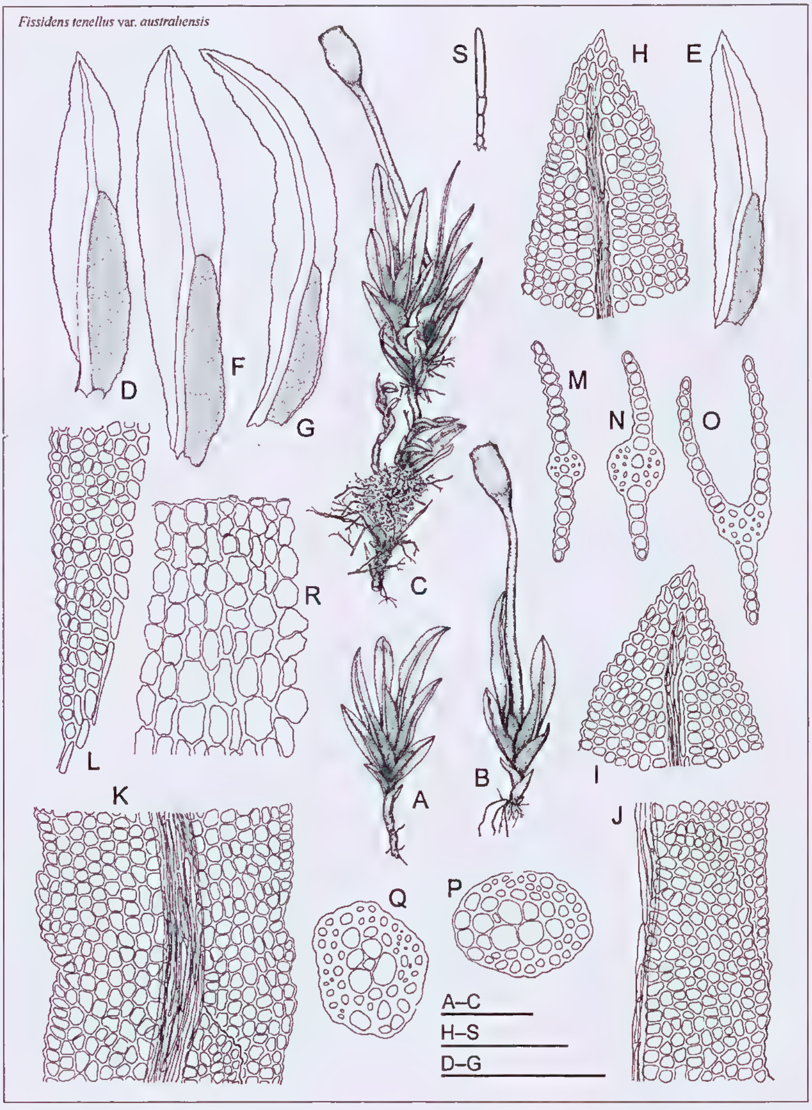

Fig. 18. ***Fissidens tenellus*** Hook.f. & Wilson var. ***australiensis*** (A.Jaeger) J.E.Beever & I.G.Stone. Drawn from: Tasmania: Tasman Peninsula, SE end of Safety Cove, near Port Arthur, *P.Brownsey s.n.*, (HO 117034, ex WELT M 26055b).

A–C. Plants; **D, E.** Stem leaves; **F, G.** Perichaetial leaves; **H, I.** Cells of leaf apex; **J.** Cells of upper part of vaginant laminae; **K.** Cells of dorsal lamina, apical lamina and upper part of vaginant laminae; **L.** Cells of proximal part of dorsal lamina; **M, N.** Sections of leaf through apical lamina; **O.** Section of leaf through dorsal and vaginant laminae; **P, Q.** Stem sections; **R.** Exothecial cells; **S.** Axillary hair.

SCALES: = 1.0 MM (A–C); = 0.5 MM (D–G); = 100 µM (H–S).

EXCLUDED SPECIES

Fissidens berteroi (Mont.) Müll.Hal., *Syn. Musc. Frond.* 1: 45 (1848), as *berterii*

Conomitrium berteroi Mont., *Ann. Sci. Nat. Bot., sér.* 2, 8: 250 (1837) – as *berterii* Type: Chile: Guillota, *C.Bertero s.n.*, 1829. Holotype: PC. Isotypes: BM,

Conomitrium muelleri Hampe, *Linnaea* 28: 214 (1856). *Fissidens muelleri* (Hampe) Mitt., *Trans. R. Soc. Vict.* 19: 91 (1882)[1883]. Holotype: Australia: Victoria; ad ripas fluvis Murray, *F.Mueller s.n.*, BM. Isotype: MEL.

Fissidens fontanus sensu Scott & Stone, *The Mosses of Southern Australia* (1976) *non F. fontanus* (Bach.Pyl.) Steud.

ILLUSTRATIONS: G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia* 91, pl. 10, 1976, as *F. fontanus*; R.A.Pursell, *Mem. New York Bot. Gard.* 45: 655, fig. 45 (1987); J.Beever, B.Malcolm & N.Malcolm, *The Moss Genus* Fissidens *in New Zealand: an illustrated key* 18 (2002). (**Fig. 19**)

Plants aquatic, periodically emergent; yellowish-green to dark green. **Stems** usually much branched, to 12 cm or more long; in section lacking a central strand. **Leaves** lanceolate to linear-lanceolate, to *c.* 8.5 mm long, 0.9 mm wide, in many pairs, often ±distant, **apex** acute; **margins** smooth; **vaginant laminae** reaching $^{2}/_{5}$–$^{1}/_{2}$ the leaf length, almost closed, **elimbate** or **weakly limbate** in lower $^{1}/_{3}$ of lamina; **dorsal lamina** reaching the insertion or failing above; **laminal cells** unistratose, irregularly hexagonal, 13–24 × 11–15 µm, larger juxtacostally. **Costa** *bryoides*-type, ending well below the apex.

Autoicous. Perigonia and **perichaetia** gemmiform, axillary. **Sporophytes** one or more per perichaetium, small and relatively inconspicuous. **Setae** short, 0.9–1.4 mm long. **Capsules** symmetrical, ovate, 0.5–0.8 mm long; **exothecial cells** thin-walled, collenchymatous; **operculum** short, conical-rostrate. **Peristome** variable, reduced *bryoides*-type, the forks unequal, spirally thickened and papillose, basal part ±smooth to finely papillose, papillae often in vertical rows. **Spores** round, 15–18 µm.

In Australia, occurs in S.A., Qld, N.S.W., Vic.

Usually growing in running water attached to rocks or tree roots and often forming large floating masses coated with diatoms.

Also in Lord Howe Island, New Zealand and southern South America.

Australian collections have often been misidentified as *F. fontanus* (Bach.Pyl.) Steud., a predominantly European and North American species that differs in having unequal vaginant laminae and being completely elimbate.

The species is recorded in error for Tasmania in Catcheside (1980) and Streimann & Klazenga (2002). No authentic collections from the State have been located in any Australian herbaria and the species, although it may subsequently be found, is thus removed from the Tasmanian flora.

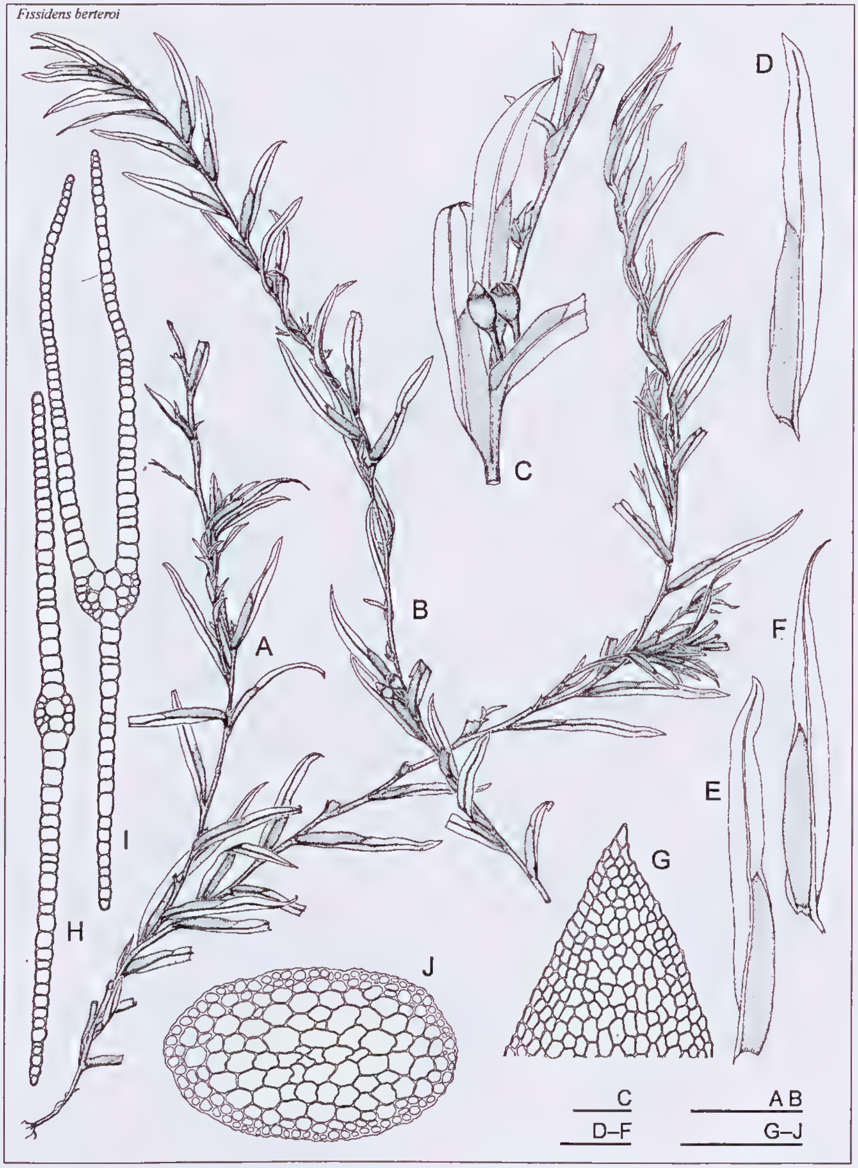

Fig. 19. ***Fissidens berteroi*** (Mont.) Müll.Hal.
Drawn from: New Zealand: Wellington, Masterton, Makoura Stream, *A.Perrie s.n.*. (WELT M38784).

A, B. Fertile shoots; **C.** Detail of fertile shoot with sporophytes and perigonia; **D–F.** Stem leaves; **G.** Cells of leaf apex; **H.** Section of leaf through apical lamina; **I.** Section of leaf through dorsal and vaginant laminae; **J.** Stem section.

Scales: = 5.0 mm (A, B); = 1.0 mm (C); = 1.0 mm (D–G); = 100 μm (H–S).

Acknowledgements

The present study developed from my undertaking a revision of the genus *Fissidens* for the Moss Flora of Australia, initiated by the late Ilma Stone and the late David Catcheside. I thank Pat McCarthy for providing access to manuscript material prepared by Ilma for the Flora. I am particularly grateful to Ilma for her guidance and encouragement over many years. Jessica Beever, Auckland, has freely shared her knowledge of the genus in New Zealand. The late Ron Pursell, Emeritus Professor at the University of Knoxville, Tennessee, foremost in his knowledge of *Fissidens*, sadly passed away before I had much chance to utilise his depth of experience. I am grateful to a number of Australian bryologists for their support and encouragement, for sharing their collections, and their feedback on various versions of the keys to identification of Australian species, particularly Andi Cairns, Andrew Franks, David Meagher, Alison Downing, Lyn Cave and Jean Jarman. Jean Jarman and Lyn Cave provided considerable help in the final preparation of figures for publication and in commenting on various drafts of the manuscript. Access to herbarium specimens has been provided by curators at CANB, HO, MEL, MELU, and NSW.

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THE LICHEN FAMILY HYMENELIACEAE IN TASMANIA, WITH THE DESCRIPTION OF A NEW SPECIES

Gintaras Kantvilas

Kantvilas, G., 2014. The lichen family Hymeneliaceae in Tasmania, with the description of a new species. *Kanunnah* 7: 127–140. ISSN 1832-536X. The family Hymeneliaceae in Tasmania comprises three species: the widespread *Tremolecia atrata* (Ach.) Hertel and *Hymenelia lacustris* (With.) M. Choisy, and *Hymenelia gyalectoidea* Kantvilas, a new endemic species described from alpine altitudes where it is confined almost exclusively to dolerite. All taxa are described and illustrated from Tasmanian collections. The enigmatic generic position of the new lichen is discussed.

Gintaras Kantvilas, Tasmanian Herbarium,
Box 5058, UTAS LPO, Sandy Bay, Tasmania, Australia 7005.
Email: Gintaras.Kantvilas@tmag.tas.gov.au

KEY WORDS: ascus, biodiversity, *Eiglera*, taxonomy, *Hymenelia*, *Ionaspis*, *Tremolecia*

INTRODUCTION

The family Hymeneliaceae is a small group of lichens, characterised chiefly by a crustose thallus containing a green photobiont (either trebouxioid or *Trentepohlia*), usually aspicilioid apothecia immersed in the thallus surface, and mostly weakly amyloid or non-amyloid asci containing eight, simple, colourless ascospores. Many species have an attractive, bright orange thallus. The composition of the family has varied over the years. Eriksson (2006) included *Aspicilia* A.Massal., *Eiglera* Hafellner, *Hymenelia* Kremp., *Ionaspis* Th.Fr., *Lobothallia* (Clauzade & Cl. Roux) Hafellner, *Melanolecia* Hertel and *Tremolecia* M.Choisy, and thus subsumed the families Aspiciliaceae, Eigleraceae and Tremoleciaceae within the Hymeneliaceae. More recently, Lumbsch & Huhndorf (2010) included *Aspicilia* and *Lobothallia* in the Megasporaceae (see also Nordin *et al.* 2010) but retained the other genera in the Hymeneliaceae. *Tremolecia* is a monotypic genus that was re-instated by Hertel (1977) and is widely applied without controversy. Separation of *Hymenelia* and *Ionaspis* on the other hand has been regarded as problematic (Lutzoni

& Brodo 1995) and depended in the past chiefly on the photobiont: trebouxioid in the former and *Trentepohlia* in the latter. Taxonomic treatments of these genera are few and include the monograph of *Ionaspis* by Magnusson (1933) and various regional accounts, for example Jørgensen (1989), Galloway (2007), Owe-Larsson & Nordin (2007) and Fletcher *et al.* (2009a, b).

Hafellner (1984) examined and described the ascus structure of several genera in the family, but the problem of generic delimitation was not tackled in depth until Lutzoni & Brodo (1995) devised a new classification, based on new typifications of the genera and cladistic analysis of a broad suite of characters. Thus *Hymenelia* is typified by *H. prevostii* [see discussion and lectotypification by Lutzoni & Brodo (1995)] whereas *Ionaspis* is typified by *I. chrysophana* (= *I. suaveolens*) (Lutzoni & Brodo 1994, 1995). In these authors' concept, the photobiont is a minor character, and the genera are separated chiefly by epihymenial pigments and their reaction in dilute HNO_3 and KOH. Furthermore, *Hymenelia* tends to have wider ascospores and a thicker hymenium, and, unlike *Ionaspis*, includes many calcicolous and endolithic species. As a result of this work, many of the described species effectively 'swapped' genera. Subsequently Lumbsch (1997) investigated the ontogeny of *Eiglera* and compared it with, amongst other taxa, that of *Hymenelia* and *Ionaspis*.

Unfortunately, I have found aspects of this new classification difficult to apply, and a brief survey of a wide range of herbarium material of many species did not, in my opinion, support a clear distinction between those taxa now placed in *Hymenelia* and those in *Ionaspis*. Nor, for that matter, was the previous, photobiont-based arrangement much better. All taxa studied share an essentially identical ascus type and general morphology, whereas other details such as excipular structure, morphology of the paraphyses and ascospore size vary across the whole complex. Lutzoni & Brodo (1995) stressed the occurrence of epihymenial pigments, but these are also variable, within species, populations and specimens. Indeed in this author's experience, the distribution of pigments in many groups of lichens, for example, *Megalaria* and *Mycoblastus*, is potentially fickle, even at species level, and its application as a taxonomic character needs to be approached with extreme caution (Kantvilas 2008, 2009). Furthermore, pigmentation is often linked to other morphological, anatomical and ecological characters and thus specimens from exposed habitats may have more intense pigmentation, a thicker thallus, and a more robust apothecial margin.

In this paper, the three Tasmanian species of the family Hymeneliaceae are treated. In addition to the widespread *Tremolecia atrata*, these include two species classified here in *Hymenelia*. Of these, one is probably amongst the most common and conspicuous lichens found at alpine elevations, and is new to science. Due to the complexities discussed above, I have elected to use the older generic name *Hymenelia* for this species. Clearly the problem of generic classification in the Hymeneliaceae requires further investigation and perhaps adopting a conservative (or controversial position) in this paper may hasten such a study.

MATERIAL AND METHODS

The study is based on collections of the author, housed in the Tasmanian Herbarium (HO), and on comparative material in other herbaria, chiefly in London's Natural History Museum (BM) and the National Herbarium of Victoria (MEL). Anatomical and morphological observations were undertaken using light microscopy, with thin hand-cut sections mounted in water, 10% KOH, 50% HNO_3, Lactophenol Cotton Blue, ammoniacal erythrosin and Lugol's Iodine, with and without pretreatment with KOH. Ascospore measurements are based on at least 50 observations and are presented in the format: 5th percentile–*average*–95th percentile, with outlying values given in parentheses. Chemical composition was investigated by thin-layer chromatography using standard methods (Orange *et al.* 2001). Nomenclature of ascus types essentially follows Hafellner (1984).

Selected comparative material examined

Eiglera flavida (Hepp) Hafellner. SWEDEN: SE of Mt Skarsen, 62°44'N 12°17'E, 8.viii.1998, *R. Santesson* 32468 (*Lich. Sel. Exsicc. Upsal.* 57) (BM). SLOVAKIA: Velký Stoh, 17.vi.1965, *I. Pišút & A. Vězda* (*A. Vězda: Lich. Sel. Exsicc.* 407) (BM).

Hymenelia arctica (Lynge) Lutzoni. SWEDEN: in River Ljusnan, 62°41'N 112°24'E, 8.viii.1994, *R. Santesson* 33668 (*Lich. Sel. Exsicc. Upsaliensis* 125) (BM).

Hymenelia carnulosa (Arnold) Lutzoni FRANCE: Naodabfall der Chaine de la Sainte Baume, Plan d'Aups, vi.1978, *Y. Rondon* (*G Follman: Lich. Exsicc. Sel.* 306) (BM); Sainte Baume, 19.ix.1967, *J. Asta, G. Cauzade, J.M. & Y. Rondon* (*A. Vězda: Lich. Sel. Exsicc.* 657) (BM) [both as *H. coerulea* (DC.) A. Massal.]. GERMANY: Lohbachgraben an der Kampenwand bei Aschau, vii.1895, *Schnabl* (BM).

Hymenelia cyanocarpa (Anzi) Lutzoni. SWEDEN: in River Ljusnan, 62°41'N 112°24'E, 8.viii.1994, *R. Santesson* 33669 (*Lich. Sel. Exsicc. Upsal.* 126) (BM); Limön Island in Lake Långban, 59°50'N 14°17'E, 14.viii.1984, *L.-E. Muhr* 7650 (*Lich. Sel. Exsicc. Upsal.* 7) (BM).

Hymenelia epulotica (Ach.) Lutzoni. FRANCE: Provence, near Apt, 8.i.1965, *G. Clauzade* (*A. Vězda: Lich. Sel. Exsicc.* 337) (BM). UNITED KINGDOM: East Perth, Glen Shee, 7.vii.1964, *P.W. James* (BM).

Hymenelia heteromorpha (Kremp.) Lutzoni. UNITED KINGDOM: Cumbria, Westmorland, Great Dun Fell, above Knock, vi.1993, *O.L. Gilbert & A.M. Fryday* (BM). SARDINIA: Monte Albo, 900 m alt., 25.vii. 1985, *P.L. Nimis & J. Poelt* (HO).

Hymenelia prevostii (Duby) Kremp. UNITED KINGDOM: North Somerset, Cheddar Gorge, 11.iv.1981, *P.W. James* (BM). NORWAY: near Mosterhavn, viii.1912, *J.J. Havaas* (*J.J. Havaas: Lich. Norv. Occid.* 73) (BM).

Hymenelia rhodopsis (Sommerf.) Lutzoni. SWEDEN: shore of Lake Älvlången, 59°26'N 14°48'E, *L.-E Muhr* 13632 (*Lich. Sel. Exsicc. Upsal.* 127) (BM).

Ionaspis ceracea (Arnold) Hafellner & Turk. ITALY: (*Anzi: Lich. rar. Langob.* 76) (BM). GERMANY: Westl. Höhenwälder (*M. Britzelmayr: Lichenes Bavariae Exsiccati* 381) (BM).

Ionaspis chrysophana (Körb.) Th. Fr. AUSTRIA: Bremmer, 11.viii.1871, *F. Arnold* 458 (BM); GERMANY: Sperrbache bei Oberstdorf im Altgäu, 1859, *Rehm* (BM). UNITED KINGDOM: Cairngorm summit, 6.viii.1968, *P.W. James* (BM).

Ionaspis (Hymenelia) lacustris (With.) Lutzoni. U.S.A.: North Carolina, White Water Gorge, *W.L. Culberson & B. Nebel* 10117 (BM). NORWAY: Hordaland, 1937, *J.J. Havaas* (*J.J. Havaas: Lich. Norv. Occid.* 169) (BM). UNITED KINGDOM: Mid Ebudes, Tiree, SE Balephuil Bay, 10.iv.1983, *P.W. James* (BM); Lake District, Coniston, by Simons Nick, 29.iv.1984, *O.W. Purvis* (BM). IRELAND: Co. Galway, Connemara, Doughruagh Mtns, *H. Hertel* 39600 (*H. Hertel: Lecideaceae Exsicc.* 343) (HO).

Ionaspis odora (Ach.) Th. Fr. CZECH REPUBLIC: Mumlava, 28.vii.1960, *A. Vězda* (*A. Vězda: Lich. Sel. Exsicc.* 53) (BM). SLOVAKIA: Žiarska dolina, 14.ix.1966, *I. Pišút* (*Lich. Slov. Exsicc.* 129) (BM). POLAND: Pańszczyca Valley, 29.viii.1971, *J. Nowak* (*Lich. Pol. Merid. Exsicc.* 112) (BM). GREENLAND: Romer Sø, 80°59'N 19°29'W, 27.vii.1995, *E.S. Hansen* (*Lich. Groenl. Exsicc.* 580) (BM).

Ionaspis ventosa P.M. Jørg. & R. Sant. SWEDEN: Mt Stora Mittåkläppen, 62°43'N 12°21'E, 14.viii.1989, *R. Santesson* 32679 (*Lich. Sel. Exsicc. Upsal.* 85) (BM).

Tremolecia atrata (Ach.) Hertel. PRINCE EDWARD ISLAND: Kents Crater, 46°37'S 37°54'E, 170 m alt., 1982, *H. Hertel* (*H. Hertel: Lecideaeae Exsicc.* 100) (HO).

TAXONOMY

Hymenelia gyalectoidea Kantvilas sp. nov.

Mycobank No. MB810701

Species insignis, saxorum alpinorum apricorum incola, thallo ferrugineo, algas chlorococcaleas continenti, apotheciis urceolatis vel gyalectoideis, 0.2–0.35 µm latis, ascis egregiis tholo amyloideo, et ascosporis halonatis, hyalinis, 12–21 µm longis, 7–14 µm latis designata.

TYPE: Australia, Tasmania: Hartz Mtns, near start of track to Arve Falls, 43°13'S 146°46'E, 790 m alt., on dolerite plates in subalpine heathland, 25 July 2007, *G. Kantvilas* 280/07 (HO–holotype; BM, MSC–isotypes).

Thallus pale to bright rusty orange, sometimes bleached a little pale greyish here and there, forming extensive, continuous, irregular, undelimited patches up to many 10s of cms wide, lacking a prothallus, deeply cracked, 200–750 µm thick, ecorticate but with a diffuse outer layer to *c.* 50–100 µm thick that is orange, unchanged in K or N; medulla white, I–, K/I–; photobiont a unicellular green alga with individual cells globose to subglobose, rarely ± oblong, 6–10 x 5–10 µm, occurring singly or occasionally in pairs. *Apothecia* scattered, typically uncommon and inconspicuous, 0.2–0.35 mm wide, round or irregularly deformed-roundish, hemiangiocarpic, at first immersed in the thallus, at maturity usually adnate, urceolate to gyalectoid; disc pale orange to ± colourless and translucent, concave, eventually excavate and eroded; proper

Fig. 1. Habitat of *Hymenelia gyalectoidea*, with numerous extensive orange thalli colonising an alpine dolerite boulder field.

excipulum at first rather ragged and dentate, incurved, prominently extending above the level of the disc and thallus and ± obscuring the former, later becoming ± erect to recurved and abraded, concolorous with the thallus or paler and ± translucent, sometimes in part with a sparse orange pruina, in section ± cupulate, rather poorly differentiated from adjacent tissues, 10–50(–60) µm thick at the sides, colourless to pale orange, unchanged in K and N, composed of branched and anastomosed hyphae 1–2 µm thick, radiating from beneath the hypothecium. *Hypothecium* colourless, 40–70 µm thick, typically inspersed with oil droplets. *Hymenium* 70–90(–110) µm thick, I+ grubby blue-green, K/I+ intense blue, colourless throughout or sometimes overlain by a continuous or patchy, granular, orange epithecial layer 20–40 µm thick, intensifying orange in K. *Asci* 60–85 x 12–30 µm, clavate, approximating a modified Hymeneliaceae-type: tholus well-developed, mostly ± non-amyloid except for a diffuse, thin, intensely amyloid, inner cap; ocular chamber not developed. *Paraphyses* 1–2 µm thick, sparingly branched and anastomosed, not moniliform; apices neither pigmented nor enlarged. *Ascospores* broadly ellipsoid to ovate, sometimes almost subglobose, hyaline or occasionally pale orange when post-mature, thin-walled, typically with a prominent halo, 12–*15.3*–20(–21) x (7–) 8–*10.0*–13(–14) µm. *Pycnidia* occasional, scattered, immersed in the thallus, visible

Fig. 2. Habit of *Hymenelia gyalectoidea*. The orange crustose thallus forms colourful mosaics with other species, in this case the yellow thallus of *Cameronia pertusarioides* and black tufts of the moss, *Andreaea*.

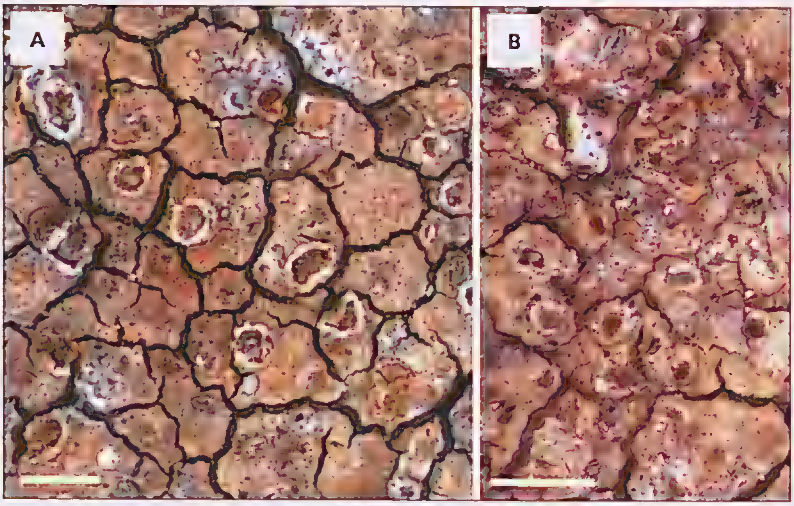

Fig. 3. Habit of *Hymenelia gyalectoidea* (detail).
A. gyalectoid apothecia (*Kantvilas* 2/97); **B.** pycnidia (*Kantvilas* 256/12).
Scale = 0.5 mm.

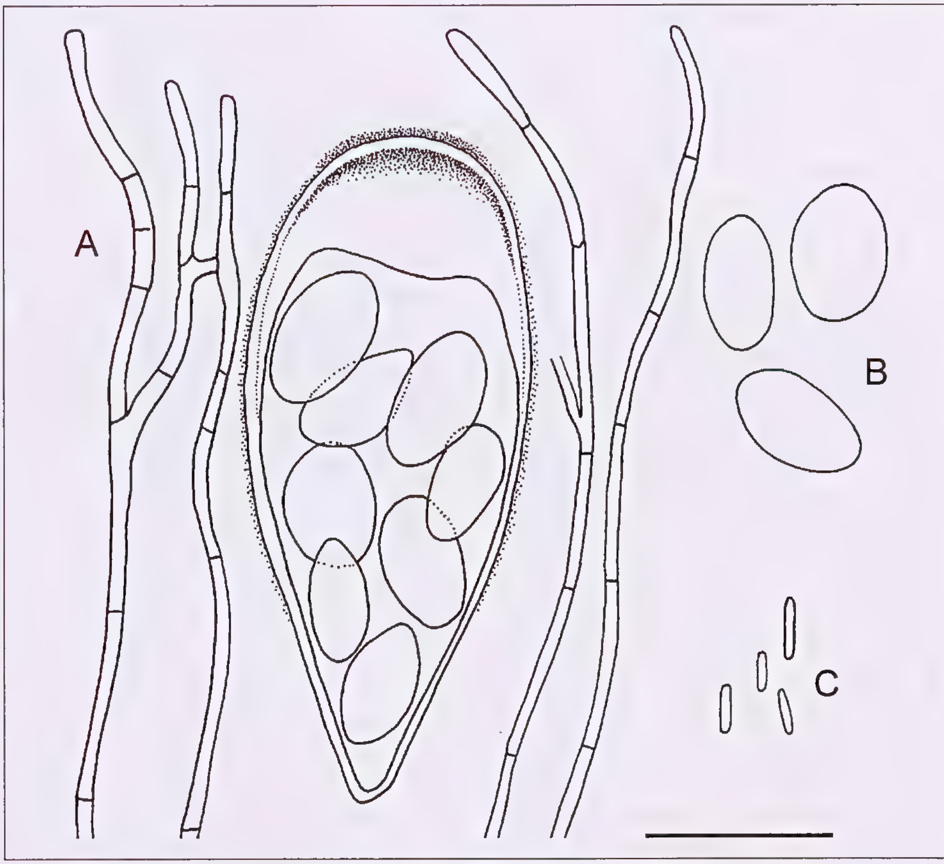

Fig. 4. Anatomy of *Hymenelia gyalectoidea* (semi-schematic).
A. asci, ascopores and paraphyses, with amyloid parts stippled; **B.** ascospores; **C.** conidia.
Scale = 20 µm.

as slightly more heavily orange-pigmented specks, pierced by a minute hole, sometimes gaping a little and resembling incipient apothecia. *Conidia* bacilliform, 3–6 x 0.8–1 µm. *Chemistry*: no substances detected. (**Figs 1–4**)

ETYMOLOGY: the specific epithet refers to the distinctive form of the apothecia.

ECOLOGY AND DISTRIBUTION: *Hymenelia gyalectoidea* is one of the most common and eye-catching saxicolous, crustose lichens found in sunny, exposed aspects at alpine and subalpine elevations in Tasmania. That it has gone unidentified and un-named for so long is entirely due to the rarity of fertile material and the inconspicuousness of its tiny, often immersed fruiting bodies. It is found almost exclusively on Jurassic

dolerite, and hence occurs mainly in central and eastern parts of Tasmania. Although also recorded on other substrata such as Triassic sandstone, Devonian granite and Precambrian quartzite, these occurrences are rare and usually restricted to sites where dolerite occurs in close proximity. The orange thallus of the new species is largely responsible for the orange-brown patterns that are characteristic of the alpine dolerite provenance, and it has featured (un-named) in many Tasmanian wilderness photographs that are disseminated via calendars and other media. Its colour should not be confused with the brightly orange-coloured lichens of coastal habitats, which belong to the unrelated family Teloschistaceae; the pigment of these coastal species reacts K+ purple.

Alpine dolerite is a very favourable substratum for lichens and and its hard, weathering-resistant surface is typically colonised in its entirety by extensive communities of crustose, foliose and fruticose species. The orange thallus of the new *Hymenelia* tends to form very attractive mosaics with other brightly coloured crustose lichens, such as *Cameronia pertusarioides* Kantvilas and *Poeltiaria coromandelica* (Zahlbr.) Rambold & Hertel (pale yellow), *Lecanora demersa* (Kremp.) Hertel & Rambold and *Rimularia albotesselata* Kantvilas (white), *Trapelia lilacea* Kantvilas & Elix (pale purplish), *Rhizocarpon geographicum* (L.) DC. (green) and *Ramboldia petraeoides* (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix (brown), as well as black tufts of the moss *Andreaea*.

SELECTED SPECIMENS EXAMAINED: Tasmania: Mt Wellington summit peaks, 42°54'S 147°14'E, 1963, *P.W. James* (BM, HO); Mount Hartz, 43°15'S 146°46'E, 1290 m alt., 1966, *G.C. Bratt* 3083a *& F. Lakin* (HO); Mt Victoria, western slopes, 41°20'S 147°50'E, 1000 m alt., 1997, *G. Kantvilas* 2/97 (E, HO); Forty Lakes Peak, 41°44'S 146°26'E, 1350 m alt., 2006, *G. Kantvilas* 384/06 (HO); Wylds Craig, 42°28'S 146°23'E, 1335 m alt., 2007, *G. Kantvilas* 10/07 (HO); Snowdrift Tarns, 42°55'S 146°39'E, 1270 m alt., 2009, *G. Kantvilas* 437/09 (HO); Mt Byron, 42°02'S 146°04'E, 1370 m alt., 2011, *G. Kantvilas* 164/11 (HO); Mt Sprent, saddle N of peak, 42°47'S 145°58'E, 910 m alt., 2012, *G. Kantvilas* 73/12 (HO); Mt Rufus at the Gingerbread Hut, 42°08'S 146°06'E, 1260 m alt., 2012, *G. Kantvilas* 256/12 (HO); Skullbone Plains, 42°02'S 146°21'E, 970 m alt., 2012, *G. Kantvilas* 719/12 (HO); Lake Skinner, 42°56'S 146°41'E, 975 m alt., 2013, *G. Kantvilas* 415/13 (HO); Smiths Monument, Mount Wellington, 42°55'S 147°13'E, 1140 m alt., 2014, *G. Kantvilas* 11/14 (HO).

REMARKS: This distinctive species is characterised by the combination of the rusty orange thallus, the chlorococcoid photobiont, the tiny, gyalectoid apothecia, the distinctive Hymeneliaceae-like asci, and the relatively large, halonate ascospores. Within the Tasmanian lichen flora there are no taxa with which it could be confused. Most crustose lichens with an orange thallus belong to the genus *Caloplaca* and are easily macroscopically distinguished, not least by the presence of anthraquinone pigments that react K+ purple. Some members of the Lecideaceae (including Porpidiaceae), especially species of *Porpidia s. lat.*, may have an orange thallus but are distinguished by their dark apothecia and different ascus

types. The only other species of *Hymenelia* known from Tasmania is *H. lacustris*, but this occurs in semi-aquatic habitats, has aspicilioid apothecia with a smooth margin and *Hymenelia*-type asci. *Tremolecia atrata*, another member of the Hymeneliaceae, has a dull reddish brown thallus, black, carbonised apothecia with greenish pigments, and non-halonate ascospores.

There is one further *Hymenelia*-like taxon in Tasmania that remains unidentified. It occurs in habitats akin to those of *H. gyalectoidea*, and is known from several collections from the drier eastern side of the Central Plateau. It has a somewhat duller orange thallus and scattered, apothecia-like structures with a glossy brown 'disc'. No hymenial tissue has been located despite extensive sectioning, and so, although the photobiont and anatomical arrangement suggest it is either an unusual, sterile form of *H. gyalectoidea* or a further taxon of *Hymenelia*, the status of this material is unresolved.

The combination of diagnostic characters of *H. gyalectoidea* is unique within the family as a whole. However, the generic placement of the species is uncertain and I include it in *Hymenelia*, the older of the two generic names available, with great reservations, my main aim being to bring this taxon to the attention of the broader scientific community and highlight it as a subject for further investigation. Under the scheme proposed by Lutzoni & Brodo (1995), this taxon would perhaps be better placed in *Ionaspis* on account of its lack of epihymenial pigments that react in N and its siliceous habitat. It also displays certain superficial similarities to several taxa currently placed in *Ionaspis*, notably *I. ceracea*, *I. lacustris*, *I. obtecta* and *I. odora*. These taxa have an epilithic thallus that is often orange and generally lack any epithecial pigments. However, in each case their apothecia are aspicilioid, with a relatively robust, entire excipulum, and their asci are of the *Hymenelia*-type (**Fig. 5**C), with a well-developed weakly or non-amyloid tholus. In contrast, the asci of the new species are enigmatic: their overall shape is *Hymenelia*-like, but there is a distinct, weakly amyloid diffuse cap in the uppermost part of the tholus (**Fig. 4**A). Hints of this structure were observed in some preparations of asci of other taxa from the *Hymenelia-Ionaspis* complex. This observation led to a re-examination of the genus *Eiglera*, which differs from *Ionaspis* and *Hymenelia* by having an intensely and entirely amyloid tholus (**Fig. 5**A). The faintly amyloid 'cap' in *H. gyalectoidea* could perhaps be interpreted as a trend towards an *Eiglera*-type ascus. Further anatomical and morphological similarities between the two taxa are that both have generally small, superficial, rather urceolate apothecia with a poorly developed excipulum and a disc that becomes easily eroded, pockmarked and rather excavate. However, there is no evidence to suggest that the new species is better placed in *Eiglera*. The asci of *Tremolecia* (**Fig. 5**B) are different again.

Hymenelia lacustris **(With.) M. Choisy** *Bull. Mens. Soc. linn. Lyon* 18: 145 (1949); ***Ionaspis lacustris*** (With.) Lutzoni, *Syst. Bot.* 20: 253 (1995); *Lichen lacustris* With., *Arr. Brit. pl. ed.* 3, 4: 21 (1796).

Thallus rusty or pale orange to cream or pale fawn-brown in deep shade, effuse, usually deeply cracked, to *c.* 300 µm thick, forming

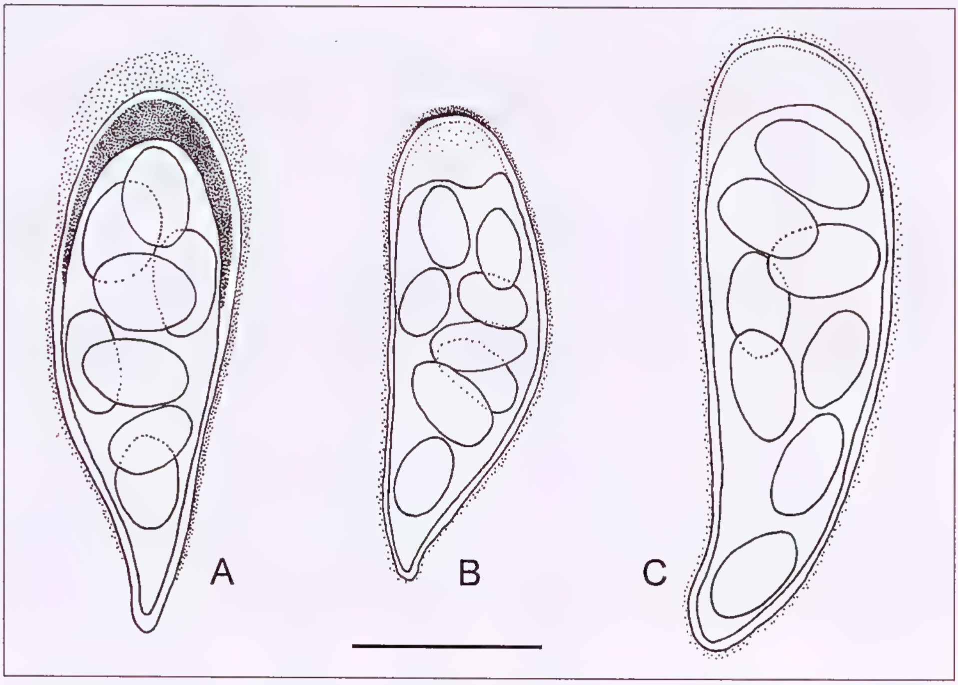

Fig. 5. Asci and ascospores (semi-schematic) of the genera of Hymeneliaceae, with amyloid parts stippled. **A.** *Eiglera*-type (*Eiglera flavida*). **B.** *Tremolecia*-type (*Tremolecia atrata*). **C.** *Hymenelia*-type (*Hymenelia lacustris*).
SCALE = 20 μm.

irregular patches, often in mosaics with other lichens, undelimited or with a thin, greyish marginal prothallus; medulla white, I–, K/I–; photobiont a unicellular green alga with individual cells globose to subglobose, 7–14 x 6–12 μm. *Apothecia* 0.1–0.5 mm wide, round, scattered or clustered, aspicilioid and sunken in the thallus; disc pale orange-pink to ± translucent pale greyish, widely exposed, smooth, persistently concave; proper excipulum entire, extending slightly above the level of the disc and thallus and forming a collar, concolorous with the thallus or a little darker at the inner edge, in section ± cupulate, poorly differentiated from adjacent tissues, 20–50 μm thick at the sides, colourless but frequently densely inspersed with orange-brown granules that do not dissolve in K, especially at the edges, lacking photobiont cells. *Hypothecium* colourless, 40–60(–140) μm thick, not inspersed. *Hymenium* 60–90 μm thick, colourless but typically overlain by a granular, orange epithecial layer *c.* 10 μm thick; no blue-green pigments present. *Asci* 50–75 x 15–20 μm, clavate, of the *Hymenelia*-type with a non-amyloid, well-developed tholus and lacking an ocular chamber. *Paraphyses* 1.5–2.5 μm thick, simple, with apices mostly not enlarged

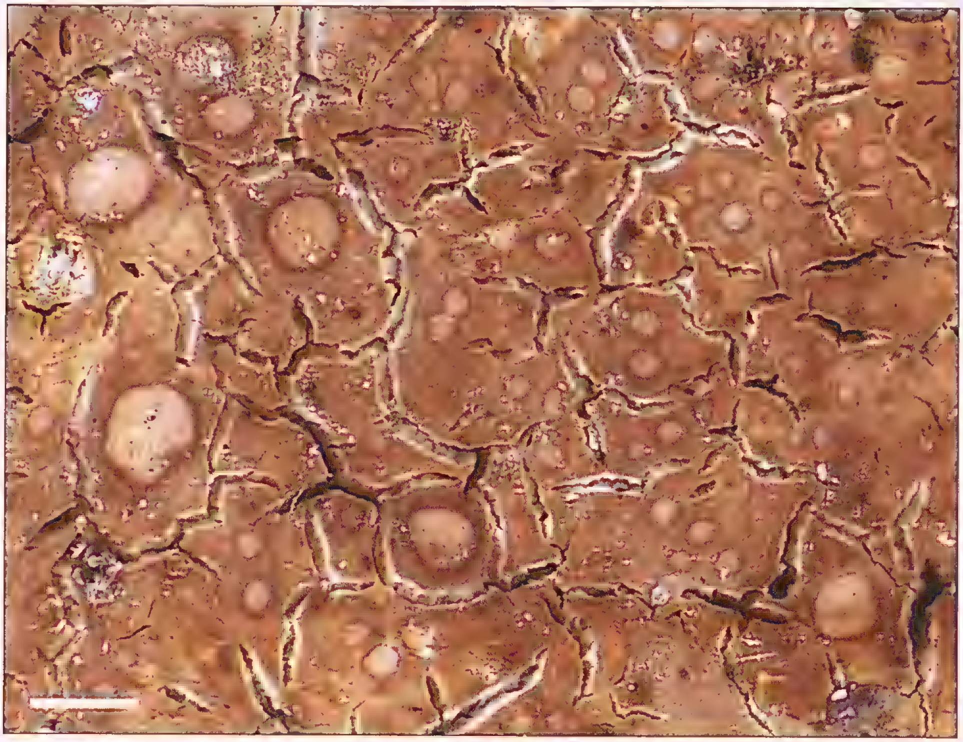

Fig. 6. *Hymenelia lacustris* habit.
Scale = 0.5 mm.

but the apical cell sometimes 3–4 µm wide. *Ascospores* ellipsoid, hyaline, thin-walled, halonate, (9–)10–*13.3*–16(–17) x 5–*6.8*–8 µm. *Pycnidia* occasional, scattered, immersed in the thallus, visible as slightly more heavily orange-pigmented specks resembling incipient apothecia. *Conidia* bacilliform, 4–6 x 1 µm. *Chemistry*: no substances detected. (**Figs 5**C & **6**)

REMARKS: This lichen is intimately associated with aquatic habitats, occurring on siliceous rocks in flowing streams where it is seasonally inundated. It is poorly represented in herbarium collections but is possibly widespread, although not common, in Tasmania. The species is recognised by the pale to bright orange thallus, which forms extensive patches or mosaics with other lichens on large cobbles and bedrock in rivers, and its aspicilioid apothecia that resemble a shallow, pale crater with a distinct rim. The former character must be considered with caution, however, as several other taxa in the same habitat may have an orange thallus when growing in or near flowing water. The species most likely to be confused with *H. lacustris* is *Poeltiaria tasmanica* Fryday with which it forms mosaics. When growing

in water, this species has a bright orange thallus and develops rather immersed apothecia with a reduced excipulum. It differs in that its apothecial disc is dark brown to black and is frequently gyrose or umbonate, and it has *Porpidia*-type asci.

SPECIMENS EXAMAINED: Tasmania: Arve River above Arve Falls, 43°13'S 146°46'E, 1993, *P.M. McCarthy* 613 *& G. Kantvilas* (MEL); Meander River, 41°42'S 146°42'E, 1993, *P.M. McCarthy* 660, 661 *& G. Kantvilas* (MEL); Huon River at Tahune picnic area, 43°06'S 146°44'E, 1993, *P.M. McCarthy* 622 *& G. Kantvilas* (MEL); Huon River near Riveaux Rapids, 43°06'S 146°40'E, 60 m alt., 2003, *G. Kantvilas* 74/03 (HO); Macquarie River at Colonels Marsh, 42°10'S 147°49'E, 370 m alt., 2009, *G. Kantvilas* 25/09 (HO); Huon River near confluence with Picton River, 43°06'S 146°43'E, 50 m alt., 2013, *G. Kantvilas* 4/13 (HO).

Tremolecia atrata (Ach.) Hertel

Ergebn. Forsch. Unternehmens Nepal Himal. 6: 351 (1977); *Gyalecta atrata* Ach., *Kongl. Vetensk. Akad. Nya Handl.* 29: 229 (1808); *Lecidea dicksonii* auct.

Thallus dark orange-red to rusty red-brown, areolate, deeply cracked, to *c.* 250 µm thick, undelimited or with a thin, black marginal prothallus, forming irregular patches to *c.* 1 cm wide, often coalescing or forming mosaics with other lichens; medulla white, I–, K/I–; photobiont a unicellular green alga with individual cells globose to subglobose, 7–14 x 6–13 µm. *Apothecia* 0.2–0.5 mm wide, round to rather angular or lobate when crowded together, sunken in the thallus and ± aspicilioid, rarely sessile; disc black, widely exposed, smooth, persistently concave; proper excipulum entire, extending slightly above the level of the disc and thallus, black or in part rusty red and concolorous with the thallus, in section cupulate, 40–70(–90) µm thick at the sides, opaque dark brown, sometimes a little paler within. *Hypothecium* colourless to pale brown, 10–40 µm thick. *Hymenium* 70–90 µm thick, colourless, typically with a grey-green epithecium *c.* 10 µm thick, K+ intensifying greenish, N+ crimson. *Asci* 42–60 x 11–21 µm, clavate, of the *Tremolecia*-type with a very weakly amyloid, well-developed tholus with a thin, external amyloid cap, and lacking an ocular chamber. *Paraphyses* 1.5–2 µm thick, sparsely branched and anastomosing; apices neither enlarged nor pigmented. *Ascospores* ellipsoid, hyaline, thin-walled, non-halonate, (9–)9.5–*12.8*–15(–16) x (5–)5.5–*6.5*–7.5(–8) µm. *Pycnidia* not found in Tasmanian specimens; *conidia* reported as bacilliform, 3–6 x 1–1.5 µm. *Chemistry*: no substances detected. (**Figs 5**B & **7**)

REMARKS: The combination of a rusty red thallus, black aspicilioid apothecia and the unique *Tremolecia*-type asci with eight, hyaline ascospores makes this species very easily recognisable. It has a typical bipolar world distribution, occurring in the Arctic, the Antarctic and in intervening alpine areas spanning temperate and tropical latitudes. Consequently, supplementary descriptive data for the species can be found in the lichen accounts of many regions, for example, Hertel (2004), Galloway (2007) and Fletcher & Hawksworth (2009). In Tasmania, it is restricted to the highest peaks and has been recorded from the Central Plateau, the Ben Lomond Plateau and Mt Wellington. *Tremolecia atrata* grows on rather

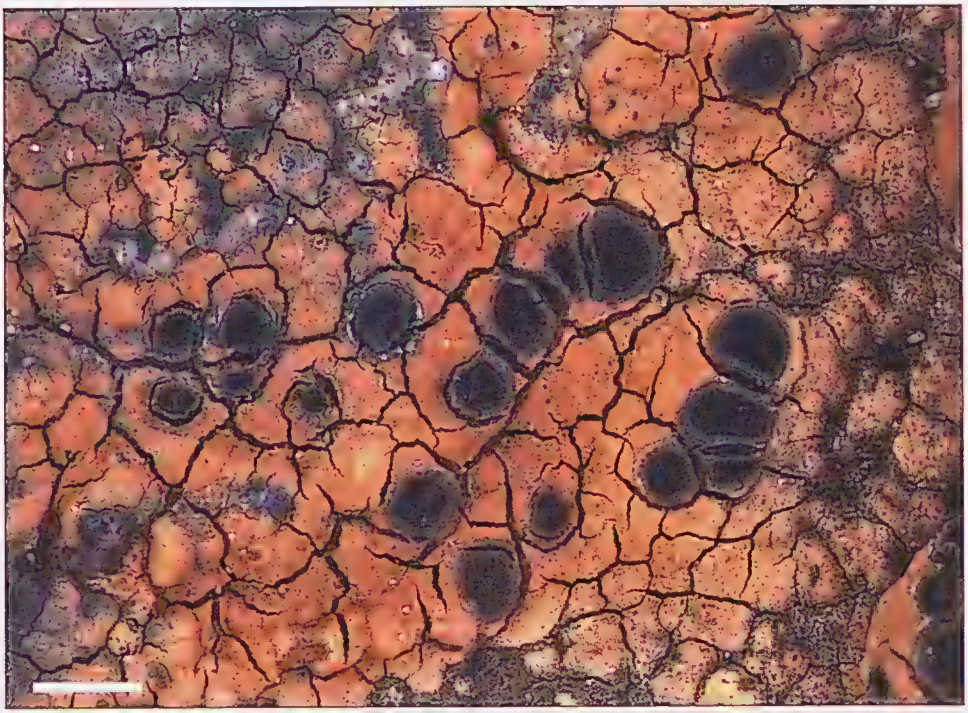

Fig. 7. *Tremolecia atrata* habit.
Scale = 0.5 mm.

smooth, hard, very exposed rocks, and has only been collected from dolerite. It is part of a rich association of crustose lichens, dominated by *Rhizocarpon geographicum* and including *Carbonea vorticosa* (Flörke) Hertel, *Lecanora polytropa* (Ehrh.) Rabenh., *Ramboldia petraeoides* and species of *Porpidia*.

Specimens examained: Tasmania: South Wellington Gap track, 42°55'S 147°14'E, 1000 m alt., 1964, *G.C. Bratt* 1507 *& J.A. Cashin* (HO); Mt Mawson, South Peak, 42°42'S 146°35'E, 1200 m alt., 1965, *G.C. Bratt* 2944b (HO); Ben Lomond, northern plateau, 41°36'S 147°40'E, 1972, *J. Adams* 72/1184 (HO); Mt Wellington, 42°54'S 147°14'E, 1260 m alt., 1984, *G. Kantvilas* 301/84b *& P. James* (HO); Lake Augusta Rd near Liawenee Canal. 41°53'S 146°37'E, 1140 m alt., 1999, *G. Kantvilas* 437/99 (HO); Goulds Sugarloaf, 42°04'S 146°00'E, 1425 m alt., 2005, *G. Kantvilas* 85/05 (HO); Blue Peaks, northern summit, 41°43'S 146°22'E, 1350 m alt., 2006, *G. Kantvilas* 529/06 (HO); Brown Mtn, 42°36'S 147°31'E, 780 m alt., 2007, *G. Kantvilas* 230/07 (HO); Adams Peak, 41°44'S 146°41'E, 1300 m alt., 2009, *G. Kantvilas* 8/09 (HO).

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NEW TASMANIAN RECORDS AND RANGE EXTENSIONS FOR MARINE MOLLUSCS FROM DREDGING SURVEYS OFF THE TASMAN AND FORESTIER PENINSULAS, SOUTH-EAST TASMANIA

Simon Grove and Robert de Little

Grove, S. and de Little, R. 2014. New Tasmanian records and range extensions for marine molluscs from dredging surveys off the Tasman and Forestier Peninsulas, south-east Tasmania. *Kanunnah* 7: 141–167. ISSN 1832-536X. Over the summer of 2013/2014, we carried out dredging surveys for marine molluscs off the coast of south-east Tasmania, in waters 12 to 131 m deep. From nine trips amounting to 70 tows, and employing a small dredge designed primarily to retain the larger molluscs, we documented the occurrence of 253 species, 243 of which we were able to assign to described taxa. Some of our identifications remain tentative, largely because many species in the regional fauna remain poorly characterised. We consider fourteen species to be newly recorded for Tasmanian waters – perhaps an indication of the level of under-recording of the local fauna, or in some cases suggestive of recent colonisation from the north as a result of strengthening currents. Some 67 species comprise an 'offshore' component to the fauna that would seldom, if ever, be beached locally. Only two feral species were caught; one was the dominant mollusc in many catches, and the other represents a range extension. Statistical analyses and examination of historical records suggest that many more species could be collected in the study-area with further sampling. Our surveys have added considerably to the knowledge-base concerning Tasmanian offshore marine molluscs, and to the TMAG collections.

Dr Simon Grove, Senior Curator of Invertebrates, Zoology Unit, Rosny Collections and Research Facility, Tasmanian Museum and Art Gallery, GPO Box 1164, Hobart 7001, Tasmania, Australia; University Associate, School of Biological Sciences, University of Tasmania, Private Bag 50, Hobart 7001, Tasmania, Australia.
Email: simon.grove@tmag.tas.gov.au

KEY WORDS: Mollusca, Tasmania, Tasman Sea, dredging

INTRODUCTION

The marine mollusc fauna of Tasmania has been a particular focus for study by collectors and researchers since the early days of the Royal Society of Tasmania (e.g. Tenison Woods, 1876). This focus continued with the foundation of the Tasmanian Museum, which saw the transfer of many valuable specimens, including type material, from the Royal Society collections to the Museum (e.g. Hardy, 1915). A few years later, a seminal publication (May, 1921) aimed to document the entire Tasmanian marine mollusc fauna then known; this list was later expanded, and illustrations added (May and McPherson, 1958). Until the publications of Richmond (1990, 1992), Grove *et al.* (2006) and Grove (2011), this 1958 publication was the most accessible source of information on the Tasmanian marine mollusc fauna. Many of the species mentioned and illustrated in it were known only from dredged specimens – and therefore represent species not covered in more recent guides. They were chiefly the result of two expeditions off the south-east coast of Tasmania. The first of these, in December 1907, involved the 25-ton steamship *Sea-Bird*, which was chartered by Charles Hedley, a curator at the Australian Museum, along with his then Hobart-based colleague, William May, a prominent local businessman and Society dignitary with a deep personal interest in the local mollusc fauna. They dredged in 100 fathoms of water, seven miles east of Cape Pillar (Hedley and May, 1908), finding some 80 species new for Tasmania. Then in March 1909, the Tasmanian Field Naturalists Club chartered the steamship *Koonookarra* for their Easter Campout on the Freycinet Peninsula; using his own equipment, May took the steamship into the Geographe Strait (the strait separating the Freycinet Peninsula from Schouten Island), and up to 10 miles east of Schouten Island, dredging in 40, 60, 80 and 100 fathoms. In the resultant publication (May, 1910), he reported on further new species for Tasmania as well as a degree of overlap with the Cape Pillar fauna.

Remarkably little further progress has been made in exploring Tasmania's deep-water mollusc fauna since these dedicated early 20th-century surveys. CSIRO conducted extensive benthic faunal sampling of the sea-mounts to the south of Tasmania, in 1997 (Koslow *et al.*, 2001); however, much of the molluscan material from this cruise awaits incorporation into the collections and databases of the Tasmanian Museum and Art Gallery (TMAG) and other museums. Undoubtedly, many other dredging events have taken place in Tasmanian offshore waters in recent decades, but most of these would have been researching other aspects of sea-floor biology, particularly in relation to fisheries, with small molluscs generally considered as by-catch at best. In any event, there has been no recent systematic documentation of the deep-water fauna close to the Tasmanian mainland. However, at least some of the specimens from some of these dredging events have since been deposited and identified at Australia's various state museums and the records made available on-line (Atlas of Living Australia, 2014). Together with the earlier publications, they form a useful baseline against which our own recording efforts can be compared.

Our own motivations for resuming dredging in south-east Tasmanian waters were modest. We aimed to test the

effectiveness of a home-made dredge for sampling marine molluscs that we would otherwise not be able to procure through beachcombing; and we wanted to augment our own collections, including those of TMAG. We also hoped to be able to collect good-quality specimens for photographing, to aid identification of poorly known taxa – including those already held in TMAG's collections.

METHODS

A permit to dredge was obtained from the Wild Fisheries Branch, Department of Primary Industries, Parks, Water and Environment. We conducted all dredging trips under this permit, in the 10-m motor-sailer, *Rambler*, belonging to RDL, who led all trips; SJG participated in four of these. For the first four trips, *Rambler* was moored at Taranna, enabling access (via the Denison Canal) to the coastal waters east of the Forestier Peninsula. For the remaining five trips, *Rambler* was moored at Port Arthur, enabling access to the stretch of coastal waters between Capes Pillar and Raoul. The boat's sounder was used to judge suitable sampling locations by providing depth readings and bottom profiles. Within the permitted sampling area, our aim was to sample from a range of water-depths, while avoiding reefs and boulder-fields that would snag the dredge, and avoiding sea-grass beds (as part of the permit conditions).

The dredge was made specifically for this study, and consisted of a sturdy, welded steel frame, 450 mm deep, and rectangular in cross-section with an opening 800 mm wide and 270 mm high. The frame was lined with galvanised steel wire sheeting with a 6.5 mm mesh-size. The front of the dredge bore a steel cross-chain and clip, to enable its attachment to 500 m of 8-mm bore polypropylene tow-rope, which was stored in a plastic drum on the rear deck of the boat. Total weight of the dredge was 9 kg, although one or two additional weights of 0.8 kg each were added to the mouth of the dredge for some of the later tows in deeper water, to assist in keeping the lip of the dredge in contact with the substrate. To further discourage the front of the dredge from lifting off the sea-floor when deployed and to offset the buoyancy of the rope, a 1 kg weight was clipped to the rope 10 m in front of the mouth; in deeper water, a second similar weight was clipped on once about 100 m of rope had been deployed.

Deployment involved attaching the dredge's cross-chain to the end of the rope and then lowering the dredge over the stern of the boat. The rope had previously been marked by attaching cable-ties at 50 metre intervals to assist in determining the length of rope deployed. Though it was not readily apparent as to when the dredge had made contact with the substrate and started sampling, trial and error eventually confirmed that the length of rope required was at least four times the water-depth, while motoring speed had to be kept to below two knots. We allowed the dredge to sample for 15 minutes. We employed a winch to help in recovering the dredge, a process that took from 10 to 30 minutes depending on the depth. The contents of the dredge were then tipped into a white polypropylene tub on the rear deck, for sorting. Using gloves and forceps, we picked out specimens of interest and placed these into smaller sample-pots. 75% ethanol was added to these pots for preservation, unless the specimens were

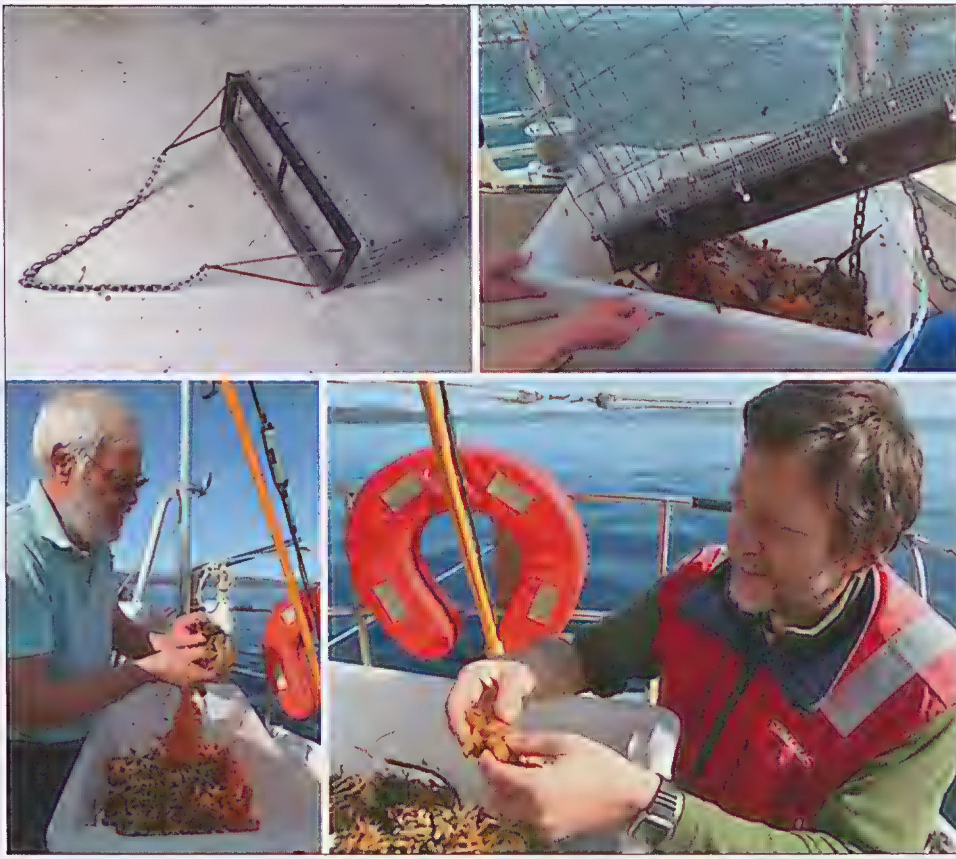

Fig. 1. The dredge, and some of the collected material being examined by the authors Robert de Little, left, and Simon Grove, right.

empty shells only, in which case they were stored dry. On a few occasions, bucketsful of promising-looking dredge material were taken back to base for sorting. Molluscs were identified through reference to a range of printed and on-line publications, through comparison with specimens in the TMAG collections, and through consultation with other experts interstate. Specimens of most, but not all, species were retained, either by RDL or for the TMAG collections.

In total, we conducted nine dredging trips, from September 2013 to March 2014. Our permit limited us to ten tows per trip but this number was seldom achieved because of time constraints, which were particularly apparent when sampling deeper water. In practice, we averaged just under eight separate dredgings per trip: 70 in total. The locations sampled are listed in **Appendix 1** and plotted on **Fig. 2.** The depth range covered was from 12 m to 131 m (mean depth 55 m).

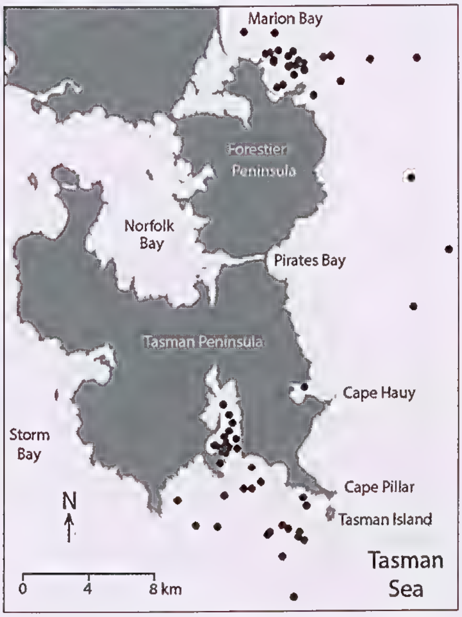

Fig. 2. The study-area in south-east Tasmania, showing dredging locations. See Appendix 1 for details of these.

To better understand how comprehensively our dredging had sampled the available mollusc fauna, we plotted sample-based species accumulation curves, based on the actual order of sampling and on a randomisation procedure (n = 100 runs), using the program *EstimateS* ver. 9.1.0 (Colwell, 2013). We used the same program to estimate asymptotic incidence-based species richness.

RESULTS

After some initial teething problems our dredging apparatus and towing techniques, as outlined above, proved to work well. In total, we recorded 253 mollusc species (Appendix 2); specimens of 139 of these have been registered into TMAG's collections. Only a single non-shelled mollusc species was recorded: juveniles of an unidentified species of *Octopus*. We were able to assign full binomial scientific names to 243 species. However, some of these names are tentative, and for some contentious taxa we have had to make our own judgements on species allocation. For instance, we have chosen to treat the gastropod 'turrid' taxa *Vexitomina garrardi* and *V. agnewi* as distinct at the species level from *V. coxi*; this in turn entails claiming *V. garrardi* as new for Tasmania.

We were able to identify six of our recorded taxa only to the level of genus, two only to family and two (unidentified yet distinct bivalves) only to class. Some of those identified only to generic level are putative undescribed species. These include a *Fax* whelk (apparently distinct from the locally common *F. tenuicostata*), and two *Notocypraea* cowries (distinct from the five described species currently known from Tasmanian waters). The south-east Australian *Notocypraea* cowries are already notorious among collectors for the occurrence of a range of deeper-water taxa that do not match the described shallow-water species; our specimens seem to represent further examples of this phenomenon.

Our dredging samples were extremely variable in both quantity and quality. Several were completely void of any material, and seven produced no molluscs at all. On other occasions the dredge was almost completely full of sponges or of dead shells (mostly those of the feral New Zealand screw-shell *Maoricolpus roseus*, which appeared in samples taken from a wide range of depths, from 16 to 125 m). The only other feral species detected was

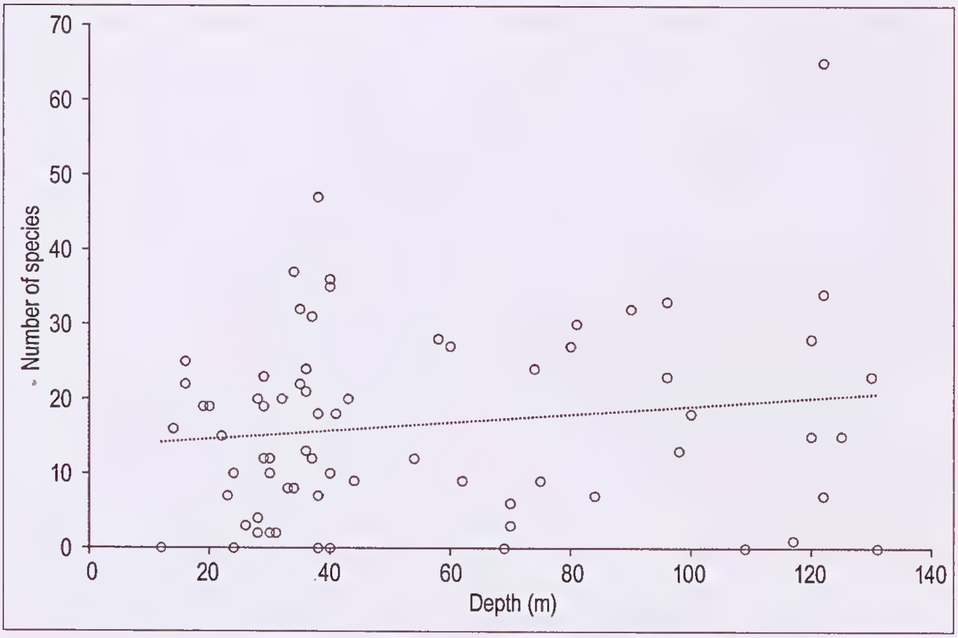

Fig. 3. Number of species of mollusc recorded per sample (n = 70) by depth of dredge. The dotted line is the linear trend-line through the data ($r^2 = 0.023$).

the European basket-shell *Corbula gibba* (from 28 and 40 m in Port Arthur).

The average number of mollusc species retrieved was 17; the most successful dredging produced 65 species. Total sample volume was not a good predictor of mollusc species richness; serendipity also played a part, for instance when micromolluscs that were theoretically small enough to be flushed out through the mesh were found lodged among larger items. To some extent these numbers are an artefact of the vigilance with which the samples were examined, because (a) the time required to examine large samples often exceeded the time available to do so between successive dredgings, and (b) common species may sometimes have been overlooked and remained undocumented because of a focus on more unusual specimens and rarities. There was no clear relationship between the number of species per dredge and dredging depth (Figure 3). The species accumulation curve (Figure 4) suggests not only that sampling is a bit hit-and-miss, but also that there should be many more species yet to be sampled from the same general area, given increased sampling effort. The Chao2 asymptotic species richness estimator was 360 species (with rather wide 95% confidence intervals of 315 and 435).

We consider fourteen of the species recorded as new for Tasmania (**Table 1**),

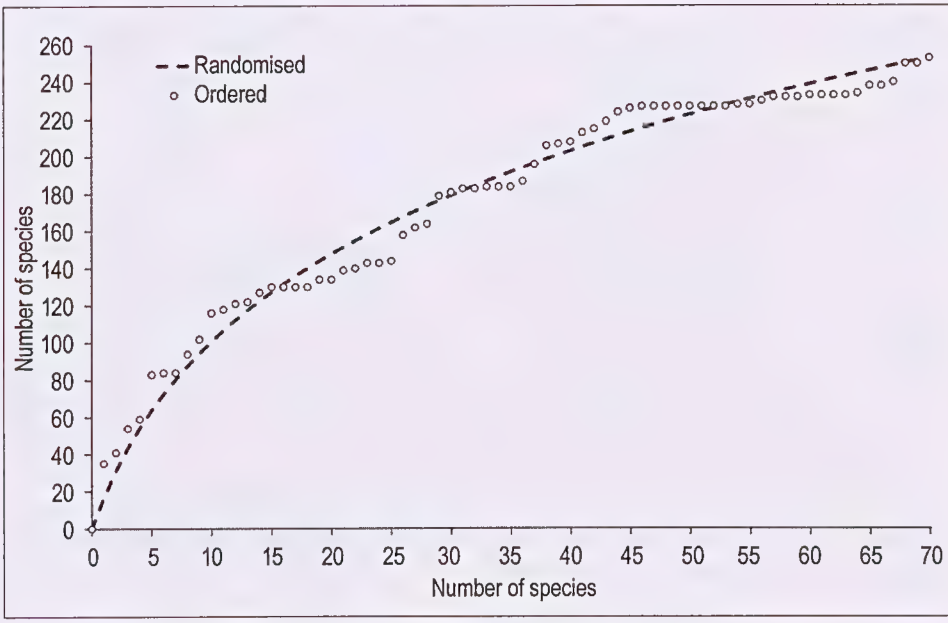

Fig. 4. Ordered (open circles) and randomised (dotted line) species accumulation curve for marine molluscs from our sampling program, based on the occurrence of all 253 species across 70 samples.

in the sense that there are no existing Tasmanian records in the Atlas of Living Australia (2014) (the Atlas includes databased mollusc records from TMAG as well as those of the Queen Victoria Museum and Art Gallery, plus state museums nationally). Of these species, half were already known from southern Australian waters (generally from New South Wales through Victoria to South Australia or Western Australia, but excluding Tasmania). One of these, *Clio recurva*, is a widespread oceanic pelagic 'sea-butterfly' whose delicate shells sink to the ocean-floor upon death of the occupant; these shells can be a dominant component of deep-sea benthic biogenic 'ooze' (Herring, 2002). For the other half, their occurrence in south-east Tasmanian waters represents a range extension of several hundred kilometres over what would previously have been considered the southern limits of an eastern Australian distribution generally spanning Queensland and New South Wales.

We consider that 67 of the species recorded are genuinely 'offshore' species that (unlike 'inshore' species) would rarely, if ever, turn up on a Tasmanian beach. Given the lack of readily available illustrations of many of these species, the figures that follow are used to illustrate some of these and their close congeners, as well as some of the other species of note that we recorded.

Some families of molluscs evidently contain many more offshore than inshore

Table 1. The 14 mollusc species recorded during this study and considered new for Tasmania.

SPECIES	COMMENTS
Lamellileda typica	A bivalve found in offshore waters around SE Australia; taxonomic status and distribution uncertain. See **Fig. 7**.
Limopsis bassi	A bivalve found in offshore waters around SE Australia; precise distribution uncertain due to past taxonomic confusion. See **Fig. 7**.
Myadora antipodum	A bivalve that attaches itself to other bivalves, living subtidally and in offshore waters around SE Australia from SE QLD to SA. N.B. Species in this genus are poorly circumscribed; identifications are therefore tentative. See **Fig. 5**.
Myadora royana	A bivalve that attaches itself to other bivalves, living subtidally and in offshore waters around southern Australia from SE NSW to SW WA. N.B. Species in this genus are poorly circumscribed; identifications are therefore tentative. See **Fig. 5**.
Thracia speciosa	A bivalve that lives subtidally and in offshore waters around SE Australia from SE QLD to SA.
Cadella subdiluta	A bivalve that lives subtidally and in offshore waters around SE Australia from E VIC to SA. Only recently recognised as a separate taxon distinct from two SE Australian congenerics (neither of which is yet recorded from TAS). See **Fig. 7**.
Epitonium coretum	A gastropod associated with anemones, occurring subtidally and in offshore waters around southern Australia from CE NSW to SW WA. See **Fig. 9**.
Tubercliopsis quinquepila	A gastropod associated with sponges, occurring subtidally and in offshore waters in SE Australia (chiefly NSW). N.B. Species in this family (Cerithiopsidae) are poorly circumscribed; identifications are therefore tentative. See **Fig. 9**.
Socienna cylindricum	A gastropod associated with sponges, occurring subtidally and in offshore waters in SE Australia (chiefly NSW). N.B. Species in this family (Cerithiopsidae) are poorly circumscribed; identifications are therefore tentative.
Dolicholatirus thesaurus	A gastropod known from a handful of records from offshore waters in E Australia (QLD and NSW). See **Fig. 9**.
Filodrillia ordinata	A gastropod known from a handful of records from offshore waters in SE Australia (NSW). See **Fig. 9**.
Vexitomina garrardi	A gastropod that lives subtidally and in offshore waters in SE Australia, from SE QLD to E Vic. N.B. Species in this genus are poorly circumscribed; identifications are therefore tentative. See **Fig. 9**.
Guraleus tasmantis	A gastropod known from a handful of records from offshore waters in SE Australia (NSW). See **Fig. 9**.
Coralliophila wilsoni	A gastropod that lives subtidally and in offshore waters in southern Australia, perhaps from C NSW to SW WA. N.B. The southern Australian species in this genus have been the subject of much taxonomic confusion, so this species' true range remains unknown. See **Fig. 9**.
Clio recurva	A pelagic gastropod found in warmer oceanic waters worldwide; on death, the shells of this species can eventually sink to the sea-bed but are rarely detected in coastal samples. See **Fig. 9**.

Fig. 5. The six dredged species in the genus *Myadora* (Myochamidae).
Upper row L–R. *M. albida*, 10 mm; *M. royana*, 20 mm (new for Tasmania); *M. complexa* 18 mm.
Lower row L–R. *M. antipodum*, 14 mm (new for Tasmania); *M. brevis*, 23 mm; *M. rotundata* 17 mm.
IMAGES: ROBERT DE LITTLE.

species in our region. One example is the bivalve family Myochamidae. On local beaches, one might expect to find only three species (*Myadora brevis, M. rotundata* and *M. complexa*); yet we found not only these three but also three additional species in our dredging samples (**Fig. 5**). The gastropod 'screw-shell' family Turritellidae is similarly much more diverse in its offshore fauna (Figure 6); of the nine species recorded, only *Maoricolpus roseus, Colpospira australis* and *Gazameda gunnii* are regularly beached. The last of these screw-shell species is listed as Vulnerable under the Tasmanian Threatened Species Protection Act (State of Tasmania, 1995), perhaps because of the perceived threat of competition from the introduced *M. roseus*. In many of our samples, *M. roseus* was indeed often very common (and probably occurred in more samples than indicated in Appendix 2), but *G. gunnii* was by no means rare, being recorded from almost half of all samples, generally as live individuals. The gastropod 'auger' family Terebridae (Figure 6) is yet another with fewer inshore (3) than offshore (6 in total) species recorded, one of which (*Terebra lauretanae*) had in Tasmanian waters previously only been recorded from deep water east of Flinders Island.

Figs 7 & **8** illustrate some additional bivalves and gastropods, respectively, representing largely offshore species which would rarely, if ever, be beached. Figure 9 illustrates some of the remaining species considered new for Tasmania.

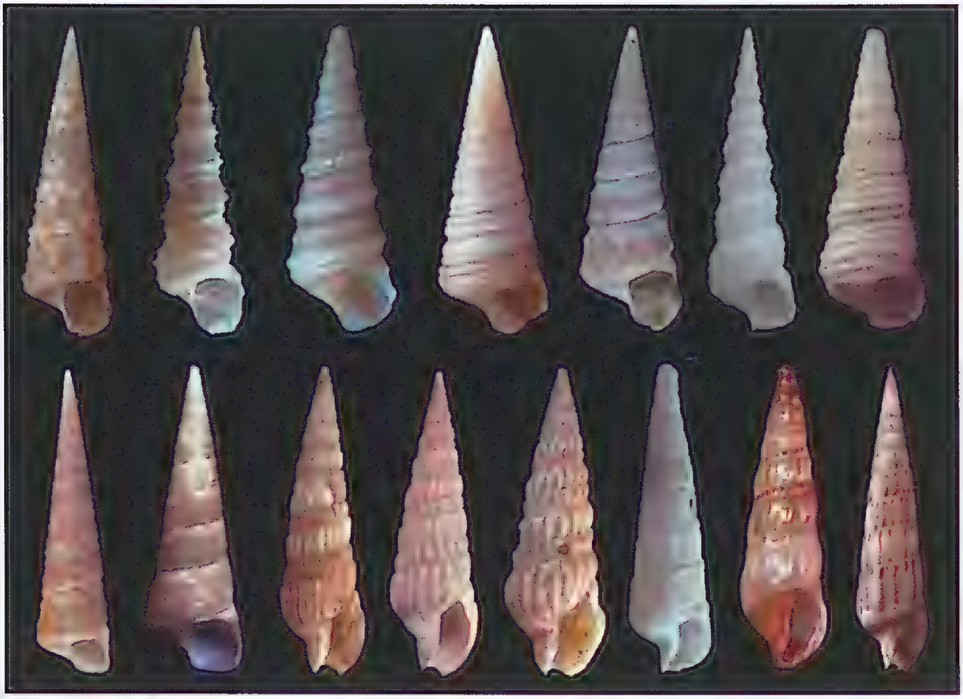

Fig. 6. The nine dredged species from the family Turritellidae, and the six from the family Terebridae.
Upper L–R. *Colpospira accisa* 22 mm; *C. atkinsoni* 18 mm; *C. australis* 19 mm; *C. circumligata* 17 mm; *C. quadrata* 15 mm; *C. smithiana* 16 mm; *C. wollumbi* 4.5 mm.
Lower L–R. *Gazameda gunnii* 41 mm; *Maoricolpus roseus* 56 mm; *Duplicaria kieneri* 27 mm; *D. ustulata* 27 mm; *Terebra assecla* 21 mm; *T. lauretanae* 21 mm; *T. tristis* 9.0 mm; *Hastula brazier* 26 mm.
Images: Robert de Little.

Conversely, our dredging produced empty shells of some very evidently 'inshore' species, sometimes from depths well beyond the range at which they would be expected to live. Examples include the intertidal, estuarine clams *Katelysia scalarina* and *K. rhytiphora*, which were dredged off Port Arthur from depths of 34 m and 120 m respectively, and the air-breathing rocky-shore siphon-shell *Siphonaria funiculata*, dredged from 36 m off the Forestier Peninsula.

DISCUSSION

Our study revealed the existence of a rich marine mollusc fauna off the south-east coast of Tasmania in water depths down to 130 m: 253 shelled mollusc species represents 18% of the total for Tasmania, based on those listed in Grove (2014). That this habitat is poorly known is demonstrated by the fact that fourteen of our species records (6%) appear to be new for Tasmania; while many others represent species that are known from very few Tasmanian records in total. Yet our sampling still only revealed a relatively small

Fig. 7. Some additional dredged species of bivalve.
Top L–R. *Propeleda ensicula* 11 mm; *Lamellileda typica* 10 mm; *Cuspidaria exarata* 32 mm.
Second L–R. *Glycymeris mayi* 14 mm; *Limopsis bassi* 7 mm (new for Tasmania); *Limopsis penelevis* 26 mm; *Thyasira adelaideana* 10 mm; *Amygdalum striatum* 49 mm.
Third L–R. *Bathycardita raouli* 27 mm; *Centrocardita rosulenta* 27 mm; *Cardiolucina crassilirata* 11 mm.
Bottom L–R. *Gari modesta* 16 mm; *Cadella subdiluta* 11 mm (new for Tasmania); *Poromya illevis* 16 mm.
IMAGES: ROBERT DE LITTLE.

proportion of the potential offshore species-pool, as gauged by the lack of asymptote on our species accumulation curve, and the statistical estimate of the asymptote suggesting the likely existence of more than 100 further sampleable species (although with a wide error margin, and with the caveat that our species-by-sample records were incomplete, as mentioned earlier). As a further measure of the extent of under-sampling, it is instructive to browse the illustrations of Tasmanian shells in May and MacPherson (1958), in which appear many additional deep-water species described as

Fig. 8. Some additional dredged species of gastropod.
Top L–R. *Emarginula dilecta* 17 mm; *E. superba* 28 mm; *Astele subcarinatum* 28 mm; *Spectamen philippensis* 8.4 mm.
Middle L–R. *Alvania filocincta* 3.0 mm; *Rissoina royana* 12 mm; *Sassia kampyla* 20 mm; *Isotriphora vercoi* 3.7 mm; *Malluvium devotus* 14 mm; *Fax tenuicostata* 19 mm.
Bottom L–R. *Austrodrillia saxea* 4.9 mm; *Epidirella tasmanica* 24 mm; *Austroginella vercoi* 7 .0 mm; *Dentimargo mayii* 9.8 mm; *Domiporta strangei* 13 mm; *Typhis phillipensis* 21 mm.
Images: Robert de Little.

having been obtained from 'off Cape Pillar' or 'off Schouten Island'. Perhaps we would need to dredge deeper than 130 m, or wider than the Forestier and Tasman Peninsulas, to ascertain the current status of these and maybe further unrecorded species. To this end we have now secured a renewal of our dredging permit for a further 12 months, with an increased range to encompass the area to the east of the southern end of Maria Island.

Many of our identifications remain tentative. One reason for tentative identifications can be the poor condition of the shell itself, which could have been sitting on the sea-floor for years since the death of its occupant. Beyond this issue, the local marine mollusc fauna contains a number of species complexes that are very difficult to identify even with intact shells, perhaps because speciation is incomplete or perhaps

Fig. 9. The dredged species considered new for Tasmania, beyond those already presented in Figs 5 to 8. **Upper L–R.** *Dolicholatirus thesaurus* 23 mm; *Filodrillia ordinata* 7.7 mm; *Guraleus tasmantis* 9.0 mm; *Vexitomina garrardi* 22 mm; *V. agnewi* 13 mm. **Lower L–R.** *Epitonium coretum* 16 mm; *Tubercliopsis quiquepila* 12 mm; *Coralliophila wilsoni* 13 mm; *Clio recurva* 19 mm.

IMAGES: ROBERT DE LITTLE.

because the species-level differences in shell features are inconsistent or inadequately characterised in the literature. This is a common problem among members of almost any taxonomic group worldwide, but may be particularly so among the south-east Australian marine fauna. It could, at least in part, be a result of the interplay,

over tens or hundreds of thousands of years, between the orientation of the major coastlines, fluctuating influences of major warm-water and cool-water currents, and sea-level changes (Waters *et al.*, 2010). During the glacial maxima of the Pleistocene, an isthmus intermittently connected the landmasses of Tasmania and Victoria, isolating populations of warmer-water marine species to the east and west of the isthmus (because the only physical connection would have been through inhospitably cold water around the south of Tasmania). In some species, the separation gave rise to sibling species that remain genetically segregated despite the lack of a physical boundary today; others show regional variation in morphology or genetic structuring consistent with a level of past isolation that only partially disrupted interbreeding once populations were free to intermix (Waters, 2008). We suspect that these phenomena may account for the difficulties we had in putting names to some members of the genera *Myadora, Neotrigonia, Purpurocardia, Notocypraea, Fax, Duplicaria, Vexitomina* and perhaps others. For *Myadora*, for instance, the most recent publications differ significantly in their interpretation of species boundaries. We have followed the more recent (and conservative) of these (Hüber, 2010).

One remarkable feature of the sampled mollusc fauna is its dissimilarity in composition from what can be found on local beaches. Over a quarter of all species recorded are 'offshore' species that would seldom, if ever, be found beached, even though our sampling may only have been within a few kilometres of the shore. It would seem that there are no local currents capable of wafting these species shorewards from these depths. On the other hand, the shells of some well-known intertidal species had made their way into much deeper water, presumably carried out on currents. These patterns mean that we can probably be fairly sure that the 'offshore' species had been living close to where they were dredged, even if the dredging only produced empty shells; however, logically we cannot conclude that 'inshore' species also live offshore.

Several of our new species for Tasmania were already well known from southern Australian waters from New South Wales to South Australia or Western Australia; finding these species for the first time in Tasmanian waters may reflect the poor state of knowledge of the local fauna. However, several others were previously considered to occur only along the eastern seaboard of mainland Australia, primarily New South Wales. Finding them for the first time off south-east Tasmania could conceivably reflect recent colonisation. The same could be true for further species that in Tasmanian waters were previously only known from the far north-east of the state – such as the auger *Terebra lauretanae* and the top-shell *Clanculus dunkeri*. The south-wards-flowing East Australian Current seasonally extends down the east coast of Tasmania in a series of eddies that can be several hundred metres deep, raising local water temperatures by several degrees and carrying the planktonic eggs and larvae of many warmth-adapted benthic species. This current has strengthened markedly in recent years (Suthers *et al.*, 2011), and may have enabled some mollusc species to spread south into south-east Tasmanian waters from their more northern core range.

The dominance of the feral screw-shell *Maoricolpus roseus* in many of our samples, from a wide range of depths, confirms a phenomenon that is well-known: the species has spread widely from its point of introduction in the Derwent Estuary in the 1920s, and has now been found living at depths down to 200 m (Probst and Crawford, 2008). In many places, this filter-feeding species must now be sequestering a high proportion of the edible detritus that would otherwise feed native species. Despite this, it appears not yet to have excluded all competition, since we often found several native filter-feeders, including several screw-shell species, living alongside it. The other feral species detected, *Corbula gibba*, seems to represent a range extension from its assumed point of introduction, in about 1996, in the Derwent / d'Entrecasteaux Channel area (Whitehead, 1998). It remains to be seen whether its preference for sheltered, organic-rich silty substrates may limit its spread further east around the open coast.

CONCLUSION

What started as a simple trial of a home-made dredge turned into a remarkably productive sampling program that revealed the existence of a rich and hitherto unsuspected marine mollusc fauna in the waters off south-east Tasmania. The sampled fauna includes many species whose core ranges lie further north and which are newly recorded for Tasmania; and the fauna has a high proportion of 'offshore' species that probably never wash up on Tasmanian beaches. The curated material and data arising from this program comprise a valuable resource for understanding species distributions in an era and region of rapid environmental change. In future years, extending the surveys further offshore and along the coast will enhance the program's value further.

Acknowledgements

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Appendix 1. Details of dredging stations, sampling dates and depths.
*Stations from which no mollusc samples were retrieved (n = 7).

DATE	STATION	VICINITY	LATITUDE	LONGITUDE	DEPTH (m)
3 September 2013	01	Visscher Island	–42.8410	147.9412	40
3 September 2013	02	Visscher Island	–42.8413	147.9592	41
3 September 2013	03	Visscher Island	–42.8462	148.0045	58
3 September 2013	04	Visscher Island	–42.8464	147.9968	60
3 September 2013	05	Visscher Island	–42.8521	147.9721	38
3 September 2013	06	Visscher Island	–42.8543	147.9624	30
3 September 2013	07	Visscher Island	–42.8547	147.9534	34
3 September 2013	08	Visscher Island	–42.8426	147.9314	32
23 October 2013	09	Visscher Island	–42.8515	147.9668	36
23 October 2013	10	Visscher Island	–42.8576	147.9729	34
23 October 2013	11	Visscher Island	–42.8476	148.1085	70
23 October 2013	12	Visscher Island	–42.8486	148.0519	75
23 October 2013	13	Visscher Island	–42.8681	148.0171	70
23 October 2013	14	Visscher Island	–42.8797	147.9838	36
23 October 2013	15	Visscher Island	–42.8528	147.9653	35
23 October 2013	16	Visscher Island	–42.8543	147.9569	33
23 October 2013	17	Visscher Island	–42.8491	147.9351	31
23 October 2013	18	Visscher Island	–42.8441	147.9265	23
11 November 2013	19	Visscher Island	–42.8454	147.9529	38
11 November 2013	20	Visscher Island	–42.8499	147.9658	37
11 November 2013	21	Visscher Island	–42.8518	147.9673	37
11 November 2013	22	Visscher Island	–42.8623	147.9604	24
11 November 2013	23	Visscher Island	–42.8705	147.9466	20
11 November 2013	24*	Visscher Island	–42.8726	147.9394	12
11 November 2013	25	Visscher Island	–42.8512	147.9358	30
11 November 2013	26	Marion Bay	–42.8259	147.9369	40
11 November 2013	27	Marion Bay	–42.8246	147.8999	22
16 January 2014	28	Visscher Island	–42.8522	147.9656	35
16 January 2014	29	Hippolyte Rocks	–42.9517	148.1017	90
16 January 2014	30	Hippolyte Rocks	–43.0132	148.1472	100
16 January 2014	31	Hippolyte Rocks	–43.0625	148.1045	96
17 January 2014	32	Fortescue Bay	–43.1259	147.9729	28
17 January 2014	33	Cape Pillar	–43.1854	147.8914	43

DATE	STATION	VICINITY	LATITUDE	LONGITUDE	DEPTH (m)
17 January 2014	34*	Port Arthur	–43.1564	147.8817	40
17 January 2014	35*	Port Arthur	–43.2143	147.9207	69
5 February 2014	36	Port Arthur	–43.2549	147.9538	120
5 February 2014	37	Port Arthur	–43.1848	147.8811	29
5 February 2014	38	Port Arthur	–43.1808	147.8785	96
5 February 2014	39	Port Arthur	–43.1466	147.8749	28
13 February 2014	40	Port Arthur	–43.1697	147.8819	43
13 February 2014	41	Port Arthur	–43.2197	147.9101	80
13 February 2014	42	Port Arthur	–43.2582	147.9319	122
13 February 2014	43	Port Arthur	–43.2797	147.9466	130
13 February 2014	44	Port Arthur	–43.2582	147.9675	120
13 February 2014	45	Port Arthur	–43.2356	147.9755	74
13 February 2014	46	Port Arthur	–43.2278	147.9709	54
13 February 2014	47	Port Arthur	–43.2022	147.9092	44
13 February 2014	48	Port Arthur	–43.1842	147.8828	29
13 February 2014	49*	Port Arthur	–43.1756	147.8767	38
24 February 2014	50	Port Arthur	–43.1747	147.8761	38
24 February 2014	51	Port Arthur	–43.1840	147.8767	29
24 February 2014	52	Port Arthur	–43.1830	147.8691	16
24 February 2014	53	Port Arthur	–43.1893	147.8778	28
24 February 2014	54	Port Arthur	–43.1858	147.8798	36
24 February 2014	55	Port Arthur	–43.1776	147.8781	36
24 February 2014	56	Port Arthur	–43.1820	147.8640	16
24 February 2014	57	Port Arthur	–43.1882	147.8745	19
24 February 2014	58*	Port Arthur	–43.1774	147.8902	24
24 February 2014	59	Port Arthur	–43.1636	147.8860	40
3 March 2014	60	Port Arthur	–43.2260	147.8760	84
3 March 2014	61*	Port Arthur	–43.2530	147.8683	109
3 March 2014	62	Port Arthur	–43.2527	147.8421	98
3 March 2014	63	Port Arthur	–43.2303	147.8205	62
3 March 2014	64	Port Arthur	–43.1985	147.8709	14
3 March 2014	65	Port Arthur	–43.2602	147.9284	122
3 March 2014	66	Port Arthur	–43.2524	147.9473	117
20 March 2014	67	Port Arthur	–43.2651	147.9726	125
20 March 2014	68	Port Arthur	–43.2626	147.9664	122
20 March 2014	69*	Port Arthur	–43.3143	147.9599	131
20 March 2014	70	Port Arthur	–43.2204	147.8995	81

Appendix 2. Taxonomic list of the 253 mollusc species identified from 70 dredge samples collected off the Forestier and Tasman Peninsulas, Tasmania, over nine trips from September 2013 to March 2014. Nomenclature and list order follows Grove (2014). Numerals following the species name refer to the dredge sample-numbers (listed in Appendix 1) from which specimen(s) were identified. * - species for which specimen(s) have been registered into TMAG's collections (n = 139). ^ - species for which specimen(s) have been retained by RDL (n = 105). # - species that are rarely, if ever, found beached in Tasmania (n = 67). > - species apparently newly recorded from Tasmanian waters (n = 15). + - feral species.

BIVALVIA

NUCULANIDAE

*^#>*Lamellileda typica* Cotton, 1930: Station 70; depth 81 m

Nuculana crassa (Hinds, 1843): Station 44, 68; depth 120, 122 m

*^#*Propeleda ensicula* (Angas, 1877): Station 36, 68; depth 120, 122 m

NUCULIDAE

*^#*Ennucula obliqua* (Lamarck, 1819): Station 1, 3, 39, 40, 48, 50, 55, 59, 65; depth 28, 29, 36, 38, 40, 43, 58, 122 m

GLYCYMERIDIDAE

*^#*Glycymeris mayi* Cotton, 1947: Station 5, 30, 31, 36, 41, 43, 62, 65, 67, 68;depth 38, 80, 96, 98, 100, 120, 122, 125, 130 m

**Tucetona flabellata* (Tenison Woods, 1878): Station 36, 41, 44, 68; depth 80, 120, 122 m

**Glycymeris striatularis* (Lamarck, 1819): Station 1, 2, 8, 9, 10, 14, 15, 27, 28, 38, 51, 52, 57, 67, 70; depth 16, 19, 22, 29, 32, 34, 35, 36, 38, 40, 41, 81, 96, 125 m

LIMOPSIDAE

^#>*Limopsis bassi* E.A. Smith, 1885: Station 44; depth 120 m

*^#*Limopsis penelevis* Verco, 1907: Station 29, 30, 31, 36, 41, 42, 43, 44, 65, 68; depth 80, 90, 96, 100, 120, 122, 130 m

PHILOBRYIDAE

Philobrya crenatulifera (Tate, 1892): Station 9; depth 36 m

Philobrya rubra (Hedley, 1904): Station 9, 65; depth 36, 122 m

LIMIDAE

**Lima nimbifer* Iredale, 1924: Station 45, 52, 56; depth 16, 74 m

**Limaria imitans* A. Adams & Reeve, 1850: Station 14, 65; depth 36, 122 m

**Limatula strangei* (Sowerby, 1872): Station 5, 10, 31, 43, 62; depth 34, 38, 96, 98, 130 m

MYTILIDAE

*^#*Amygdalum striatum* (Hutton, 1873): Station 1, 4, 12, 13, 29, 70; depth 40, 60, 70, 75, 81, 90 m

Austromytilus rostratus (Dunker, 1857): Station 44; depth 120 m

Gibbomodiola albicostata (Lamarck, 1819): Station 4, 29, 38, 52, 68; depth 16, 60, 90, 96, 122 m

Modiolus areolatus Gould, 1850: Station 3, 6, 14, 20, 30, 31, 67; depth 30, 36, 37, 58, 96, 100, 125 m

**Musculus impactus* (Hermann, 1782): Station 23, 36; depth 20, 120 m

Mytilus galloprovincialis Lamarck, 1819: Station 5, 26; depth 38, 40 m

Xenostrobus pulex (Lamarck, 1819): Station 68; depth 122 m

OSTREIDAE

Ostrea angasi Sowerby, 1871: Station 1, 2, 3, 4, 5; depth 38, 40, 41, 58, 60 m

PECTINIDAE

**Mimachlamys asperrima* (Lamarck, 1819): Station 2, 3, 4, 9, 13, 14, 27, 28, 36, 42; depth 22, 35, 36, 41, 58, 60, 70, 120, 122 m

^*Notochlamys hexactes* (Péron in Lamarck, 1819): Station 3; depth 58 m

^*Pecten fumatus* Reeve, 1852: Station 1, 3, 4, 5, 28, 29, 30, 37, 38, 46, 51, 53, 55, 57, 63; depth 19, 28, 29, 35, 36, 38, 40, 54, 58, 60, 62, 90, 96, 100 m

*^#*Talochlamys pulleineana* (Tate, 1887): Station 12, 28, 29, 30, 31, 36, 41, 43, 44, 62, 65, 68, 70; depth 35, 75, 80, 81, 90, 96, 98, 100, 120, 122, 130 m

BIVALVIA *Cont'd*

PROPEAMUSSIIDAE
*#*Parvamussium thetidis* (Hedley, 1902): Station 26; depth 40 m

VULSELLIDAE
Electroma papilionacea (Lamarck, 1819): Station 4; depth 60 m

TRIGONIIDAE
*^#*Neotrigonia gemma* Iredale, 1924: Station 29, 31, 41, 60, 63, 64, 65, 67, 68, 70; depth 14, 62, 80, 81, 84, 90, 96, 122, 125 m
**Neotrigonia margaritacea* (Lamarck, 1804): Station 3, 4, 6, 9, 10, 12, 14, 16, 18, 28, 38, 41, 48, 51, 52, 53, 54, 57, 62, 67, 68, 70; depth 16, 19, 23, 28, 29, 30, 33, 34, 35, 36, 38, 58, 60, 75, 80, 81, 96, 98, 122, 125 m

HIATELLIDAE
**Hiatella australis* (Lamarck, 1818): Station 12, 29, 44, 64; depth 14, 75, 90, 120 m
Panopea australis Sowerby, 1833: Station 41, 44, 68; depth 80, 120, 122 m

CORBULIDAE
*^+*Corbula gibba* (Olivi, 1792): Station 39, 59; depth 28, 40 m

CUSPIDARIIDAE
*#*Cuspidaria angasi* (E. A. Smith, 1885): Station 60; depth 84 m
*#*Cuspidaria exarata* Verco, 1908: Station 29, 43, 65; depth 90, 122, 130 m

CLEIDOTHAERIDAE
Cleidothaerus albidus (Lamarck, 1819): Station 5, 50; depth 38 m

MYOCHAMIDAE
*^#*Myadora albida* Tenison Woods, 1876: Station 38, 45, 68; depth 74, 96, 122 m
*^#>*Myadora antipodum* E. A. Smith, 1881: Station 11, 31, 62, 65, 68; depth 70, 96, 98, 122 m
**Myadora brevis* Sowerby, 1827: Station 1, 28, 32, 44, 68; depth 28, 35, 40, 120 m
*^*Myadora complexa* Iredale, 1924: Station 3, 4, 6, 8, 9, 10, 19, 21, 23, 28, 29, 30, 37, 38, 41, 43, 44, 47, 48, 51, 53, 54, 57, 59, 63, 64, 65; depth 14, 19, 20, 28, 29, 30, 32, 34, 35, 36, 37, 38, 40, 44, 58, 60, 62, 80, 90, 96, 100, 120, 122, 130 m
**Myadora rotundata* Sowerby, 1875: Station 10, 41, 44, 68; depth 34, 80, 120, 122 m
*^#>*Myadora royana* Iredale, 1924: Station 15, 19, 51; depth 29, 35, 38 m
*^#*Myochama anomioides* Stutchbury, 1830: Station 5, 10, 28; depth 34, 35, 38 m

POROMYIDAE
*^#*Poromya illevis* Hedley, 1913: Station 29, 65; depth 90, 122 m

PERIPLOMATIDAE
Offadesma angasi Crosse & Fischer, 1864: Station 27; depth 22 m

THRACIIDAE
^#*Thracia myodoroides* E. A. Smith, 1885: Station 5, 9; depth 36, 38 m
*#>*Thracia speciosa* Angas, 1869: Station 38; depth 96 m
**Thraciopsis peroniana* Iredale, 1924: Station 44, 68; depth 120, 122 m

CARDIIDAE
^*Acrosterigma cygnorum* (Deshayes, 1855): Station 21; depth 37 m
Fulvia tenuicostata (Lamarck, 1819): Station 3; depth 58 m
**Nemocardium thetidis* (Hedley, 1902): Station 1,
3, 4, 5, 7, 8, 9, 10, 12, 13, 15, 21, 23, 29, 36, 38, 40, 41, 43, 45, 51, 53, 57, 65, 67, 68, 70; depth 19, 20, 28, 29, 32, 34, 35, 36, 37, 38, 40, 43, 58, 60, 70, 74, 75, 80, 81, 90, 96, 120, 122, 125, 130 m

CARDITIDAE
*^#*Bathycardita raouli* (Angas, 1872): Station 1, 3, 4, 5, 41, 60, 62, 70; depth 38, 40, 58, 60, 80, 81, 84, 98 m
^*Cardita aviculina* Lamarck, 1819: Station 25, 46; depth 30, 54 m
*^*Centrocardita rosulenta* (Tate, 1887): Station 29, 31, 41, 43, 46, 62, 65, 67, 68; depth 54, 80, 90, 96, 98, 122, 125, 130 m
**Purpurocardia amabilis* (Deshayes, 1854): Station 9, 10, 12, 21, 26, 28, 30, 31, 36, 38, 41, 43, 65, 67, 68, 70; depth 34, 35, 36, 37, 38, 40, 75, 80, 81, 96, 100, 120, 122, 125, 130 m
**Purpurocardia bimaculata* (Deshayes, 1854): Station 1, 2, 3, 4, 5, 9, 15, 21, 27, 28, 30, 51, 56, 59, 65; depth 16, 22, 29, 35, 36, 37, 38, 40, 41, 58, 60, 100, 122 m

BIVALVIA *Cont'd*

CARDITIDAE *cont'd*

*#*Purpurocardia cavatica* (Hedley, 1902): Station 1, 3, 21, 23, 29, 41, 43, 44, 62, 65, 68; depth 20, 37, 38, 40, 58, 80, 90, 98, 120, 122, 130 m

*#*Vimentum dilectum* (E. A. Smith, 1885): Station 43; depth 130 m

CRASSATELLIDAE

**Eucrassatella kingicola* (Lamarck, 1805): Station 16, 41; depth 33, 38, 80 m

CYAMIIDAE

Reloncavia mactroides Tate & May, 1900: Station 26; depth 40 m

GALEOMMATIDAE

Mysella donaciformis Angas, 1878: Station 26; depth 40 m

LUCINIDAE

*^*Callucina lacteola* (Tate, 1897): Station 1, 9, 10; depth 34, 36, 40 m

*^*Cardiolucina crassilirata* (Tate, 1887): Station 10, 19; depth 34, 38 m

Divalucina cumingi (A. Adams & Angas, 1863): Station 1, 4, 10, 15, 23, 63; depth 20, 34, 35, 40, 60, 62 m

Epicodakia tatei (Angas, 1879): Station 46; depth 54 m

*^*Myrtea botanica* Hedley, 1918: Station 41, 51, 55; depth 29, 36, 80 m

Wallucina assimilis (Angas, 1868): Station 5, 26, 32, 38, 40, 50, 55; depth 28, 36, 38, 40, 43, 96 m

THYASIRIDAE

#^*Thyasira adelaideana* (Iredale, 1930): Station 40; depth 43 m

UNGULINIDAE

^*Diplodonta tasmanica* Tenison Woods, 1877: Station 5, 70; depth 38, 81 m

*^*Felaniella globularis* (Lamarck, 1818): Station 29, 43, 44, 70; depth 81, 90, 120, 130 m

**Numella adamsi* (Angas, 1867): Station 9, 37, 40, 45; depth 29, 36, 43, 74 m

MACTRIDAE

Mactra jacksonensis E. A. Smith, 1885: Station 37, 38; depth 29, 96 m

Spisula trigonella (Lamarck, 1818): Station 37; depth 29 m

MESODESMATIDAE

Atactodea erycinaea (Lamarck, 1819): Station 37; depth 29 m

Paphies elongata (Reeve, 1854): Station 10, 64; depth 14, 34 m

SOLENIDAE

**Solen vaginoides* (Lamarck, 1818): Station 5, 14, 22, 38, 50, 51, 57; depth 19, 24, 29, 36, 38, 96 m

PSAMMOBIIDAE

Gari livida (Lamarck, 1818): Station 33, 37, 38, 40, 47, 51, 52, 53, 54, 56, 57, 64; depth 14, 16, 19, 26, 28, 29, 30, 43, 44, 96 m

*^#*Gari modesta* (Deshayes, 1855): Station 9, 10, 13, 16, 17, 28, 30, 31, 38, 43, 44, 51, 52, 53, 59, 65, 67, 68, 70; depth 16, 28, 29, 31, 33, 34, 35, 36, 38, 40, 70, 81, 96, 100, 120, 122, 125, 130 m

TELLINIDAE

^#>*Cadella subdiluta* (Tate, 1887): Station 38; depth 96 m

VENERIDAE

Bassina disjecta (Perry, 1811): Station 2, 4, 5, 22, 52; depth 16, 24, 38, 41, 60 m

*^*Callista diemenensis* (Hanley, 1844): Station 1, 2, 3, 4, 5, 9, 10, 14, 15, 20, 21, 27, 28, 31, 40, 51, 52, 53, 55, 57, 62, 70; depth 16, 19, 22, 28, 29, 34, 35, 36, 37, 38, 40, 41, 43, 58, 60, 81, 96, 98 m

**Callista kingii* (Gray, 1826): Station 5, 18; depth 23, 38 m

*^*Chioneryx cardioides* (Lamarck, 1818): Station 1, 2, 5, 6, 9, 10, 21, 23, 28; depth 20, 30, 34, 35, 36, 37, 38, 40, 41 m

*^*Dosinia caerulea* Reeve, 1850: Station 8, 21, 28, 38, 52, 53, 57, 64; depth 14, 16, 19, 28, 32, 35, 37, 96 m

*^*Dosinia grata* Deshayes, 1853: Station 1, 4, 5, 7, 11, 28, 29, 32, 36, 45, 53, 54, 55, 65, 68, 70; depth 28, 30, 34, 35, 36, 38, 40, 60, 70, 74, 81, 90, 120, 122 m

*#*Gouldiopa australis* Angas, 1865: Station 38; depth 96 m

Katelysia rhytiphora (Lamy, 1935): Station 44; depth 120 m

Katelysia scalarina (Lamarck, 1818): Station 10, 37; depth 29, 34 m

BIVALVIA *Cont'd*

VENERIDAE *Cont'd*

Placamen placidum (Philippi, 1844): Station 1, 3, 4, 14, 40, 51, 53, 55; depth 28, 29, 36, 40, 43, 58, 60 m

**Tawera gallinula* (Lamarck, 1818): Station 5, 10, 15, 28, 30, 33, 37, 38, 43, 51, 52, 53, 55, 56, 57, 59, 64, 65, 68; depth 14, 16, 19, 26, 28, 29, 34, 35, 36, 38, 40, 96, 100, 122, 130 m

^*Tawera lagopus* (Lamarck, 1818): Station 22; depth 24 m

UNPLACED

^*#Bivalvia unplaced 01: Station 38, 44; depth 96, 120 m

*#Bivalvia unplaced 02: Station 68; depth 122 m

CEPHALOPODA

OCTOPODIDAE

**Octopus* unplaced: Station 4, 51, 53; depth 28, 29, 60 m

GASTROPODA

EOACMAEIDAE

*^*Eoacmaea calamus* (Crosse & Fischer, 1864): Station 5, 15, 21, 22, 27, 52, 56; depth 16, 22, 24, 35, 37, 38 m

LEPETIDAE

Propilidium tasmanicum (Pilsbry, 1895): Station 26; depth 40 m

LOTTIIDAE

Patelloida latistrigata (Angas, 1865): Station 56; depth 16 m

Patelloida victoriana (Singleton, 1937): Station 14; depth 36 m

PATELLIDAE

Scutellastra peronii (Blainville, 1825): Station 9; depth 36 m

PHASIANELLIDAE

Phasianella australis (Gmelin, 1791): Station 26; depth 40 m

**Phasianella ventricosa* Swainson, 1822: Station 68; depth 122 m

FISSURELLIDAE

Amblychilepas javanicensis (Lamarck, 1822): Station 26; depth 40 m

^*Cosmetalepas concatenatus* (Crosse & Fischer, 1864): Station 67; depth 125 m

Emarginula candida (A. Adams, 1851): Station 37, 64; depth 14, 29 m

*^*Emarginula dilecta* (A. Adams, 1851): Station 29, 43, 68; depth 90, 122, 130 m

*^#*Emarginula superba* (Hedley, 1906): Station 29, 31, 42, 45, 66, 67, 68; depth 74, 90, 96, 117, 122, 125 m

Macroschisma tasmaniae Sowerby, 1866: Station 21; depth 37 m

CALLIOSTOMATIDAE

Astele armillata (Wood, 1828): Station 70; depth 81 m

*^*Astele subcarinata* (Swainson, 1855): Station 14, 29, 31, 43, 44, 68; depth 36, 90, 96, 120, 122, 130 m

**Calliostoma legrandi* (Tenison Woods, 1876): Station 1, 2, 7, 15, 19, 20, 26, 27, 28, 41; depth 22, 34, 35, 37, 38, 40, 41, 80 m

TROCHIDAE

Bankivia fasciata (Menke, 1830): Station 10, 26, 56, 64, 68; depth 14, 16, 34, 40, 122 m

Chlorodiloma odonte (Wood, 1828): Station 10; depth 34 m

*^*Clanculus aloysii* Tenison Woods, 1876: Station 2, 5, 10, 14, 15, 20, 23, 26, 27, 28, 52, 53, 56, 70; depth 16, 20, 22, 28, 34, 35, 36, 37, 38, 40, 41, 81 m

**Clanculus dunkeri* (Koch, 1843): Station 10; depth 34 m

Clanculus limbatus (Quoy & Gaimard, 1834): Station 2, 5, 10, 18, 68; depth 23, 34, 38, 41, 122 m

Clanculus plebejus (Philippi, 1851): Station 9; depth 36 m

GASTROPODA *Cont'd*

TROCHIDAE

Gibbula hisseyiana (Tenison Woods, 1876): Station 56; depth 16 m

**Phasianotrochus eximius* (Perry, 1811): Station 10, 40, 68; depth 34, 43, 122 m

**Phasianotrochus irisodontes* (Quoy & Gaimard, 1834): Station 10, 40, 56, 59; depth 16, 34, 40, 43 m

**Phasianotrochus rutilis* (A. Adams, 1853): Station 5, 12, 15, 18; depth 23, 35, 38, 75 m

SOLARIELLIDAE

*^#*Spectamen philippensis* Watson, 1881: Station 6, 9, 30, 45, 65, 68; depth 30, 36, 38, 74, 100, 122 m

TURBINIDAE

**Bellastraea aurea* (Jonas, 1844): Station 2, 5, 21, 27, 46, 56, 64; depth 14, 16, 22, 37, 38, 41, 54 m

BATILLARIIDAE

Zeacumantus diemenensis (Quoy & Gaimard, 1834): Station 5, 10; depth 34, 38 m

CERITHIIDAE

*^*Cacozeliana granaria* Kiener, 1842: Station 5, 14, 16, 21, 22, 23, 26, 28, 56; depth 16, 20, 24, 33, 35, 36, 37, 38, 40 m

DIALIDAE

Diala suturalis (A. Adams, 1853): Station 26; depth 40 m

TURRITELLIDAE

*#*Colpospira accisa* (Watson, 1881): Station 3, 4, 13, 15, 20, 26, 41, 42, 44, 60, 68, 70; depth 35, 37, 40, 58, 60, 70, 80, 81, 84, 120, 122 m

*#*Colpospira atkinsoni* (Tate & May, 1900): Station 3, 4; depth 58, 60 m

**Colpospira australis* (Lamarck, 1822): Station 14, 37, 40, 41, 47, 54, 57, 68; depth 19, 29, 30, 36, 43, 44, 80, 122 m

*^#*Colpospira circumligata* (Verco, 1910): Station 37, 38, 40, 45, 48, 54, 63; depth 29, 30, 43, 62, 74, 96 m

*^#*Colpospira quadrata* (Donald, 1900): Station 3, 4, 9, 10, 16, 19, 20, 21, 27, 28, 45, 68, 70; depth 22, 33, 34, 35, 36, 37, 38, 58, 60, 74, 81, 122 m

*^#*Colpospira smithiana* (Donald, 1900): Station 44, 60, 68; depth 84, 120, 122 m

#^*Colpospira wollumbi* Garrard, 1972: Station 1; depth 40 m

*^*Gazameda gunnii* (Reeve, 1848): Station 1, 2, 3, 4, 7, 8, 9, 10, 14, 15, 16, 18, 20, 21, 23, 27, 28, 30, 32, 38, 45, 46, 48, 51, 52, 53, 54, 55, 56, 57, 60, 63, 68, 70; depth 16, 19, 20, 22, 23, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 40, 41, 54, 58, 60, 62, 74, 81, 84, 96, 100, 122 m

*+*Maoricolpus roseus* (Quoy & Gaimard, 1834): Station 1, 2, 3, 4, 5, 6, 7, 8, 15, 19, 28, 29, 38, 47, 48, 50, 52, 55, 56, 62, 67, 70; depth 16, 29, 30, 32, 34, 35, 36, 38, 40, 41, 44, 58, 60, 81, 90, 96, 98, 125 m

CALYPTRAEIDAE

**Sigapatella calyptraeformis* Lamarck, 1822: Station 1, 5, 14, 15, 22, 28, 51, 52, 56, 57, 68; depth 16, 19, 24, 29, 35, 36, 38, 40, 122 m

**Sigapatella hedleyi* (E. A. Smith, 1915): Station 38, 45, 47; depth 44, 74, 96 m

EATONIELLIDAE

Crassitoniella erratica (May, 1913): Station 26; depth 40 m

CYPRAEIDAE

Notocypraea angustata (Gmelin, 1791): Station 57; depth 19 m

^#*Notocypraea* TAS sp 01: Station 42; depth 122 m

^#*Notocypraea* TAS sp 02: Station 43; depth 130 m

EPITONIIDAE

^#>*Epitonium coretum* (Iredale, 1936): Station 38; depth 96 m

JANTHINIDAE

Janthina janthina (Linnaeus, 1758): Station 29; depth 90 m

ACLIDIDAE

^*Austrorissopsis consobrina* (Tate & May, 1900): Station 27; depth 22 m

MURCHISONELLIDAE

Murchisonellidae unplaced: Station 27; depth 22 m

NATICIDAE

Conuber conicus (Lamarck, 1822): Station 15, 23, 52, 53, 57, 64; depth 14, 16, 19, 20, 28, 35 m

GASTROPODA *Cont'd*

NATICIDAE *Cont'd*
**Conuber controversus* (Pritchard & Gatliff, 1913): Station 41, 64, 68; depth 14, 80, 122 m
**Eunaticina umbilicata* (Quoy & Gaimard, 1833): Station 5, 21, 44, 48, 65; depth 29, 37, 38, 120, 122 m
*^*Friginatica beddomei* (Johnston, 1884): Station 21, 48, 56, 65, 70; depth 16, 29, 37, 81, 122 m
^*Naticarius subcostatus* (Tenison Woods, 1878): Station 5; depth 38 m
Sinum zonale (Quoy & Gaimard, 1833): Station 38; depth 96 m
*#*Tanea luculenta* (Iredale, 1929): Station 68; depth 122 m

ANABATHRIDAE
**Pisinna bicolor* (Petterd, 1884): Station 23; depth 20 m
^*Pisinna tasmanica* (Tenison Woods, 1876): Station 4; depth 60 m

RISSOIDAE
*^#*Alvania filocincta* Hedley & Petterd, 1906: Station 12, 68; depth 75, 122 m
Lironoba unilirata (Tenison Woods, 1878): Station 26; depth 40 m
Rissoina fasciata (A. Adams, 1853): Station 57; depth 19 m
^#*Rissoina royana* (Iredale, 1924): Station 37, 45; depth 29, 74 m
Rissoina unplaced: Station 68; depth 122 m

RANELLIDAE
Cabestana spengleri (Perry, 1811): Station 29; depth 90 m
**Cabestana tabulata* (Menke, 1843): Station 10, 31; depth 34, 96 m
*^*Monoplex parthenopeum* (von Salis, 1793): Station 13, 56, 59; depth 16, 40, 70 m
**Ranella australasia* (Perry, 1811): Station 8, 19, 21, 23; depth 20, 32, 37, 38 m
Sassia eburnea (Reeve, 1844): Station 54; depth 30 m
*^#*Sassia kampyla* (Watson, 1885): Station 29, 30, 31, 36, 41, 42, 43, 44, 45, 62, 65, 68; depth 74, 80, 90, 96, 98, 100, 120, 122, 130 m
**Sassia parkinsoniana* (Perry, 1811): Station 3, 6, 7, 18, 20, 21, 62, 65, 70; depth 23, 30, 34, 37, 58, 81, 98, 122 m
*#*Sassia petulans* (Hedley & May, 1908): Station 30, 68; depth 100, 122 m
^*Sassia subdistorta* (Lamarck, 1822): Station 10, 19, 26, 37; depth 29, 34, 38, 40 m
**Sassia verrucosa* (Reeve, 1844): Station 9, 14, 45, 56, 68; depth 16, 36, 74, 122 m

TONNIDAE
Semicassis semigranosa (Lamarck, 1822): Station 1, 15, 28, 29, 31, 37, 38, 51, 57, 64, 68; depth 14, 19, 29, 35, 40, 90, 96, 122 m

CERITHIOPSIDAE
**Prolixodens dannevigi* (Hedley, 1911): Station 19; depth 38 m
^>*Tubercliopsis quinquepila* (Laseron, 1951): Station 68; depth 122 m

NEWTONIELLIDAE
**Ataxocerithium serotinum* (A. Adams, 1855): Station 1, 3, 5, 7, 19, 23, 26, 68; depth 20, 34, 38, 40, 58, 122 m
*#>*Socienna cylindricum* (Watson, 1886): Station 68; depth 122 m

TRIPHORIDAE
**Aclophoropsis festiva* (A. Adams, 1851): Station 1, 2, 26; depth 40, 41 m
*^*Brucetriphora granifera* (Brazier, 1894): Station 3, 26; depth 40, 58 m
**Hedleytriphora fasciata* (Tenison Woods, 1879): Station 19, 26; depth 38, 40 m
^#*Isotriphora vercoi* Marshall, 1983: Station 68; depth 122 m
*^*Monophorus angasi* (Crosse & Fischer, 1865): Station 1, 3; depth 40, 58 m
^*Monophorus nigrofuscus* (A. Adams, 1851): Station 3, 68; depth 58, 122 m

HIPPONICIDAE
*^#*Malluvium devotus* (Hedley, 1904): Station 29, 30, 31, 41, 43, 44, 65, 67, 68; depth 80, 90, 96, 100, 120, 125, 130 m

TRIVIIDAE
**Ellatrivia merces* (Iredale, 1924): Station 8, 44, 68; depth 32, 120, 122 m

VERMETIDAE
**Serpulorbis sipho* (Lamarck, 1818): Station 5, 45; depth 38, 74 m

GASTROPODA *Cont'd*

BUCCINIDAE

*^#*Fax tenuicostata* (Tenison Woods, 1877): Station 15, 21, 36, 37, 38, 40, 41, 43, 44, 45, 47, 48, 54, 56, 67, 68, 70; depth 16, 29, 30, 35, 37, 43, 44, 74, 80, 81, 96, 120, 122, 125, 130 m

#*Fax* unplaced: Station 70; depth 81 m

Penion maximus (Tryon, 1881): Station 26; depth 40 m

**Tasmeuthria clarkei* (Tenison Woods, 1876): Station 21, 27, 45, 46; depth 22, 37, 54, 74 m

COLUMBELLIDAE

**Anachis atkinsoni* (Tenison Woods, 1876): Station 23, 26; depth 20, 40 m

**Mitrella austrina* (Gaskoin, 1851): Station 26, 40; depth 40, 43 m

**Mitrella leucostoma* (Gaskoin, 1852): Station 19, 33, 56; depth 16, 26, 38 m

**Mitrella lincolnensis* (Reeve, 1859): Station 1, 8, 20, 22, 23, 26; depth 20, 24, 32, 37, 40 m

**Mitrella menkeana* (Reeve, 1859): Station 1, 2, 26; depth 40, 41 m

Mitrella semiconvexa (Lamarck, 1822): Station 10; depth 34 m

**Pseudamycla miltostoma* (Tenison Woods, 1877): Station 1, 19, 26, 40; depth 38, 40, 43 m

Zella beddomei Petterd, 1884: Station 8; depth 32 m

FASCIOLARIIDAE

^#>*Dolicholatirus thesaurus* (Garrard, 1963): Station 38; depth 96 m

Fusinus undulatus (Perry, 1811): Station 1, 21; depth 37, 40 m

Australaria australasia (Perry, 1811): Station 3, 4, 20, 36, 41, 52, 53, 56; depth 16, 28, 37, 58, 60, 80, 120 m

*^*Fusinus novaehollandiae* (Reeve, 1847): Station 1, 2, 9, 10, 14, 15, 19, 21, 28, 29, 31, 36, 40, 42, 44, 45, 51, 52, 56, 65, 68, 70; depth 16, 29, 34, 35, 36, 37, 38, 40, 41, 43, 74, 81, 90, 96, 120, 122 m

NASSARIIDAE

**Nassarius nigellus* (Reeve, 1854): Station 1, 4, 5, 6, 8, 10, 14, 16, 19, 23, 26, 28, 29, 37, 38, 50, 52, 53, 54, 55, 56, 57, 64, 68, 70; depth 14, 16, 19, 20, 28, 29, 30, 32, 33, 34, 35, 36, 38, 40, 60, 81, 90, 96, 122 m

Nassarius pauperatus (Lamarck, 1822): Station 10; depth 34 m

Nassarius pyrrhus (Menke, 1843): Station 10; depth 34 m

CANCELLARIIDAE

**Cancellaria lactea* Deshayes, 1830: Station 6, 18, 21; depth 23, 30, 37 m

BORSONIIDAE

*^#>*Filodrillia ordinata* Laseron, 1954: Station 68; depth 122 m

CLATHURELLIDAE

^*Turrella letourneuxiana* (Crosse & Fischer, 1865): Station 8; depth 32 m

HORAICLAVIDAE

^#*Austrodrillia saxea* (Sowerby, 1896): Station 67; depth 125 m

*^#*Vexitomina agnewi* (Tenison Woods, 1879): Station 1, 2, 6, 8, 19, 21, 26, 40, 45, 68; depth 30, 32, 37, 38, 40, 41, 43, 74, 122 m

*^#>*Vexitomina garrardi* Laseron, 1954: Station 8, 14, 15, 17, 20, 21, 38; depth 31, 32, 35, 36, 37, 96 m

MANGELIIDAE

*^*Guraleus alucinans* (Sowerby, 1896): Station 21, 23, 26; depth 20, 37, 40 m

^*Guraleus tasmanicus* (Tenison Woods, 1876): Station 28, 68; depth 35, 122 m

*^#>*Guraleus tasmantis* Laseron, 1954: Station 41, 65, 68; depth 80, 122 m

**Marita compta* (A. Adams & Angas, 1864): Station 29; depth 90 m

PSEUDOMELATOMIDAE

*^#*Epidirona torquata* (Hedley, 1922): Station 1, 3, 4, 12, 14, 15, 21, 23, 25, 26, 28, 29, 40, 41, 48, 52, 55, 56, 59, 62, 65, 70; depth 16, 20, 29, 30, 35, 36, 37, 40, 43, 58, 60, 75, 80, 81, 90, 98, 122 m

RAPHITOMIDAE

^*Asperdaphne legrandi* (Beddome, 1883): Station 2; depth 41 m

TEREBRIDAE

*^#*Duplicaria kieneri* (Deshayes, 1859): Station 37, 45, 47, 48, 53, 59, 63; depth 28, 29, 40, 44, 62, 74 m

GASTROPODA *Cont'd*

TEREBRIDAE *Cont'd*

**Duplicaria ustulata* (Deshayes, 1857): Station 9, 15, 16, 20, 21, 27, 37, 46, 51; depth 22, 29, 33, 35, 36, 37, 54 m

*^*Hastula brazieri* (Angas, 1871): Station 8, 22, 37, 45, 47, 53, 54, 55, 64, 70; depth 14, 24, 28, 29, 30, 32, 36, 44, 74, 81 m

*^#*Terebra assecla* (Iredlae, 1924): Station 45, 46, 53; depth 28, 54, 74 m

^#*Terebra lauretanae* Tenison Woods, 1878: Station 65; depth 122 m

**Terebra tristis* Deshayes, 1859: Station 37, 40, 45, 46, 48, 70; depth 29, 43, 54, 74, 81 m

TURRIDAE

*^#*Epidirella tasmanica* (May, 1911): Station 70; depth 81 m

COSTELLARIIDAE

^*Austromitra analogica* (Reeve, 1845): Station 19, 56, 68; depth 16, 38, 122 m

MARGINELLIDAE

^#*Alaginella vercoi* (May, 1910): Station 11; depth 70 m

**Austroginella formicula* (Lamarck, 1822): Station 64, 68; depth 14, 122 m

*^#*Dentimargo mayii* (Tate, 1900): Station 5, 21, 28, 30, 31, 43, 44, 45, 68; depth 35, 37, 38, 74, 96, 100, 120, 122, 130 m

^#*Mesoginella olivella* (Reeve, 1865): Station 28; depth 35 m

^*Mesoginella turbinata* (Sowerby, 1846): Station 8; depth 32 m

^*Ovaginella ovulum* (Sowerby, 1846): Station 37, 38; depth 29, 96 m

**Ovaginella pisum* (Reeve, 1865): Station 68; depth 122 m

MITRIDAE

^*Domiporta strangei* (Angas, 1867): Station 68; depth 122 m

Mitra badia Reeve, 1844: Station 9, 46; depth 36, 54 m

MURICIDAE

Agnewia tritoniformis (Blainville, 1832): Station 1, 10, 22, 23, 28, 45; depth 20, 24, 34, 35, 40, 74 m

**Bedeva paivae* (Crosse, 1864): Station 1, 4, 7, 8, 10, 19, 21, 37, 38, 40, 50, 52, 53, 54, 63, 70; depth 16, 28, 29, 30, 32, 34, 37, 38, 40, 43, 60, 62, 81, 96 m

*^#>*Coralliophila wilsoni* Pritchard & Gatliff, 1898: Station 29, 44, 65; depth 90, 120, 122 m

Phycothais reticulata (Blainville, 1832): Station 65; depth 122 m

*^*Pterochelus triformis* (Reeve, 1845): Station 4, 29, 30, 31; depth 60, 90, 96, 100 m

**Prototyphis angasi* (Crosse, 1863): Station 41, 46; depth 54, 80 m

*^#*Typhis phillipensis* Watson, 1883: Station 36, 60, 63; depth 62, 84, 120 m

VOLUTIDAE

^*Amoria undulata* (Lamarck, 1804): Station 3, 5, 8, 10, 29, 38, 47, 52, 57; depth 16, 19, 32, 34, 38, 44, 58, 90, 96 m

Ericusa sowerbyi (Kiener, 1839): Station 31, 43; depth 96, 130 m

OLIVELLIDAE

^*Belloliva leucozona* (A. Adams & Angas, 1864): Station 8, 22, 26, 28; depth 24, 32, 35, 40 m

OLIVIDAE

^*Amalda marginata* (Lamarck, 1811): Station 29, 31, 65, 68; depth 90, 96, 122 m

*^*Amalda petterdi* (Tate, 1893): Station 30; depth 100 m

PYRAMIDELLIDAE

Odostomia deplexa Tate & May, 1900: Station 26; depth 40 m

^*Puposyrnola petterdi* Gatliff, 1900: Station 8; depth 32 m

HAMINOEIDAE

Liloa brevis (Quoy & Gaimard, 1833): Station 26; depth 40 m

CYLICHNIDAE

^*Adamnestia arachis* (Quoy & Gaimard, 1833): Station 31, 44, 68; depth 96, 120, 122 m

PHILINIDAE

*^#*Philine columnaria* Hedley & May, 1908: Station 38, 68; depth 96, 122 m

GASTROPODA *Cont'd*

RETUSIDAE
**Retusa atkinsoni* (Tenison Woods, 1876): Station 26; depth 40 m

CLIIDAE
^#>*Clio recurva* (Children, 1823): Station 65; depth 122 m

SIPHONARIIDAE
Siphonaria funiculata Reeve, 1856: Station 14; depth 36 m

POLYPLACOPHORA

ISCHNOCHITONIDAE
*Ischnochitonidae unplaced: Station 5, 23; depth 20, 38 m

SCAPHOPODA

GADILIDAE
^*Gadila angustior* (Verco, 1911): Station 27; depth 22 m
^*Gadila spretus* (Tate & May, 1900): Station 65; depth 122 m

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VEGETATION OF THE SKULLBONE PLAINS PROPERTY, NORTH-WEST OF BRONTE PARK

Miguel de Salas, Matthew Baker, Lynette Cave and Gintaras Kantvilas

de Salas, M.; Baker, M.; Cave, L.; and Kantvilas, G., 2014. Vegetation of the Skullbone Plains property, north-west of Bronte Park. *Kanunnah* 7: 168–188. ISSN 1832-536X. The property known as 'Skullbone Plains' was surveyed in 2012 for vascular plants (192 taxa collected), bryophytes (68) and lichens (167). The vegetation of the property is a mosaic of logged and unlogged woodland and treeless patches, and its vascular plant composition is typical of the eastern, drier edge of the lower Central Plateau. Exotic vascular plants diversity and abundance was low, as was the number of rare or threatened species. Bryophyte diversity was typical of its geographic location, however the presence of significant *Sphagnum* bogs meant that bryophyte abundance was high. Lichen biodiversity was high, and included new records for Tasmania and species new to science.

Miguel de Salas*, Matthew Baker, Lynette Cave, Gintaras Kantvilas,
Tasmanian Herbarium, Tasmanian Museum and Art Gallery.
PO Box 5058, UTAS LPO, Sandy Bay, Tasmania 7005, Australia.

*Corresponding author: Miguel.deSalas@tmag.tas.gov.au

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INTRODUCTION

Skullbone Plains is a 1647 hectare parcel of private property located at the southern edge of Tasmania's Central Plateau. The origin of the name "Skullbone Plains" is uncertain, but has been reported as being derived from a number of human skeletons that were found there, thought to have been the remains of convicts that escaped from Macquarie Harbour, or some of their pursuers who also disappeared (*The Mercury* 1923). The property is approximately 17 km north-west of Bronte Park, and 15 km north-east of Cynthia Bay, Lake St Clair. It adjoins the Tasmanian Wilderness World Heritage Area, including the Walls of Jerusalem National Park and the Central Plateau Conservation Area.

The property is situated at an elevation of between 900 and 1000 m a.s.l., with the north-westernmost boundary along the Nive River at approximately 920 m a.s.l., and some of the ridges in the vicinity of Kenneth Lagoon, near the centre of the property, at an elevation of approximately 990 m a.s.l.

The Skullbone Plains property is underlain by the same sheet of Jurassic Dolerite that forms the surface layer of much of the Central Plateau (Banks 1973). The area was heavily glaciated during the Pleistocene, and Skullbone Plains is located at the estimated eastwards edge of the Central Highlands ice cap at the time of its maximum extent (Kiernan 1990). This is apparent in the low rocky ridges, possibly composed of glacial till, which occur throughout the property.

The montane climate of the Skullbone Plains area reflects its position at the south-eastern margin of the Plateau. Temperatures are cool and frosts are common, with no reliably frost-free months in the year. Localities in the vicinity experience 90–140 frosts per year. Nearby Lake St Clair and Bronte Park have elevations approximately 200 m lower than Skullbone Plains. Their annual minimum and maximum temperatures average 2.8 °C to 13.1 °C for Lake St Clair, and 3.4 °C to 13.9 °C for Bronte Park. By comparison, Liawenee, at an elevation 100 m higher, has an average minimum of 1.5 °C and maximum of 12 °C. Skullbone Plains is situated within a marked precipitation gradient from the wetter, western part of the Plateau to its drier, eastern side. Lake St Clair, to the west, records an average of 1856 mm of rain per year, whereas Bronte Park, to the south-east, records an average of only 934 mm per year, and Liawenee, at a similar elevation to the north-east, records 983 mm per year on average.

The property has been used for grazing since the 19th century (*The Mercury* 1864) and, more recently, was used for timber harvesting (*The Mercury* 2014). It was purchased in 2011 by the Tasmanian Land Conservancy and incorporated into the National Reserve System, becoming part of the Tasmanian Wilderness World Heritage Area in June 2013. The property has been privately owned since at least the 1860s (*The Mercury* 1864) and, due to its relative inaccessibility and remoteness from popular outdoor recreation areas, is rarely visited by botanists. Prior to 2012, only four records of Tasmanian flora for the area were held by the Tasmanian State Herbarium. In 2012, Bush Blitz, an Australian Biological Resources Study (ABRS)-administered nature discovery project, organised a five-day flora and fauna survey of the new reserve, involving botanists from the Tasmanian Herbarium (Hobart), the Australian National Herbarium and the Australian National Botanic Gardens (Canberra). The results of the botanical survey, which encompassed vascular plants, bryophytes and lichens, are presented here.

METHODS

Five main areas of the Skullbone Plains property were selected to represent the range of habitats present in the reserve. **Fig. 1** and **Table 1** show the main collecting areas near the Nive River, in open plains near the central part of the property, open plains in the north-west part of the property, the area around Kenneth Lagoon, and boggy sedgeland in the southernmost corner of the property.

Table 1. Major collecting sites during Skullbone Plains survey

SITE	DESCRIPTION	LATITUDE	LONGITUDE
1.1	Riparian corridor of the Nive River	S42° 0' 32.4"	E146° 21' 46.3"
1.2	Terminus of road access to NE-corner of property	S42° 0' 45.4"	E146° 21' 42.9"
1.3	Open area near centre of property	S42° 1' 28.5"	E146° 20' 48.8"
1.4	Southern end of open area 1.3	S42° 1' 33.3"	E146° 20' 53.5"
2.1	Lagoon in SW corner of property	S42° 3' 48.8"	E146° 19' 11.7"
2.2	Southern end of Kenneth Lagoon	S42° 3' 4.3"	E146° 20' 7.4"
3.1	Car park on Lake Ina Track, east of fork in the road	S42° 2' 35.0"	E146° 19' 27.6"
3.2	Small tarn in NW-most corner of property	S42° 2' 22.5"	E146° 18' 7.9"
3.3	Main access road just NW of entrance gate	S42° 1' 22.6"	E146° 21' 4.3"
3.4	Lake Ina Track	S42° 2' 38.4"	E146° 20' 23.8"
4.1	Southernmost area of property, SW of Kenneth Lagoon	S42° 4' 2.1"	E146° 19' 31.8"
4.2	Kenneth Lagoon Road terminus	S42° 3' 51.7"	E146° 19' 23.7"
6.1	Open area near centre of property, north of 1.3	S42° 1' 23.4"	E146° 20' 48.1"
6.2	West of Sites 1.3 and 1.4	S42° 1' 30.9"	E146° 20' 36.3"
6.3	Ridge south of Kenneth Lagoon	S42° 3' 21.8"	E146° 20' 4.5"

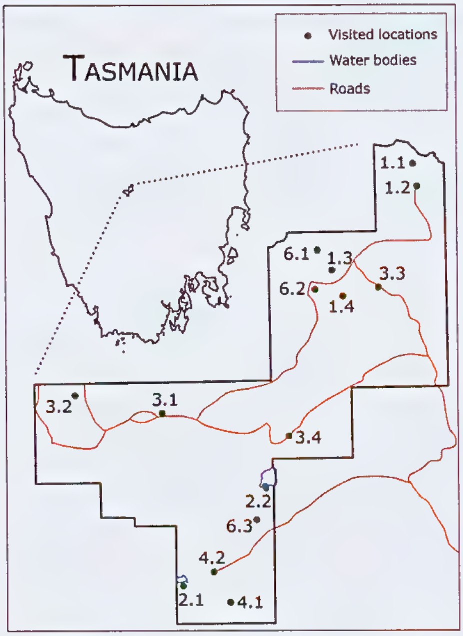

Fig. 1. Map of Skullbone Plains showing the main access roads and surveyed locations. See Table 1 (above) for coordinates of visited locations.

Sampling was undertaken mainly during the five days of the Bush Blitz field programme, 28 February to 2 March 2012, with a subsequent visit (to coincide with peak flowering) on the 12 December 2012. Our aim was to construct as complete an inventory of the flora as possible.

Vascular plant nomenclature follows Baker and de Salas (2013). Nomenclature of vegetation types and acronyms follow TASVEG (Harris and Kitchener 2005). Nomenclature for mosses follows Streimann and Klazenga (2002), that for liverworts follows McCarthy (2006), and that for lichens mainly follows McCarthy (2014).

Fig. 2: Typical landscape of Skullbone Plains showing a mosaic of wooded and non-wooded vegetation types.

RESULTS

Skullbone Plains contains a mosaic of wooded and treeless vegetation types (**Fig. 2**). Tree-covered areas were mainly dominated by *Eucalyptus delegatensis* dry woodland or forest (DDE), and *Eucalyptus coccifera* woodland (DCO), with occasional *Eucalyptus gunnii* trees usually occurring beyond the woodland margins. Other major vegetation types observed include highland *Poa* grassland (GPH), highland grassy sedgeland (MGH) and eastern alpine sedgeland (HSE), as well as Restionaceae-dominated rushland (MRR). The property contains significant areas of *Sphagnum* peatland (MSP), some of them forming unusual wave patterns, most often with an overstorey of *Richea scoparia*.

Vascular plants

Wooded areas are more common on till, on low hills and at sites with adequate drainage. They contain a heathy understorey of *Leptospermum lanigerum, Hakea epiglottis* subsp. *epiglottis, H. lissosperma, H. microcarpa, Baeckea gunniana, Leptecophylla juniperina* subsp. *parvifolia, Orites revolutus* and regenerating young *Eucalyptus* trees after logging. A significant proportion of the *Eucalyptus coccifera* and *E. delegatensis* woodland containing mature trees has been logged in the recent past and regenerating saplings of these constitute the dominant species in areas of such disturbance. Areas of high disturbance typically also contain a characteristic suite of species that include *Senecio gunnii, Hydrocotyle hirta* and *Oxalis magellanica*.

Treeless areas are largely confined to drainage channels, frost hollows, shallow soil and other areas of poor drainage. Grassland, grassy sedgeland and sedgeland overlap and blend into each other, such as in the central northern section of the property near collecting location 1.3 (**Fig. 1**). At this locality, for example, a micro-mosaic of vegetation types reflects the small-scale topography. Areas dominated by *Empodisma minus*, with an important component of *Poa gunnii*, *Carpha alpina* and accessory *Richea gunnii*, give way gradually to *Empodisma minus*, *Baloskion australe*, *Astelia alpina* and cushions of *Abrotanella forsteroides* in areas of poorer drainage. Shallow, rocky areas are dominated by *Richea gunnii*, *Baeckea gunniana* and other heath species.

In total, 192 species of vascular plants in 58 families were recorded within the Skullbone Plains property (Table 2). Of these, 177 are native and 15 are naturalised exotics, including one declared weed. Approximately a quarter (45 of 177) of the native vascular plants recorded are endemic to Tasmania. Three species found within the property are listed under Tasmania's *Threatened Species Protection Act 1995*: *Pherosphaera hookeriana*, which is listed as vulnerable, was collected at Site 1.1. *Hovea montana* and *Uncinia elegans*, which are listed as rare, were collected at Sites 1.4 and 1.1, respectively. Of the sixteen exotics encountered, only *Juncus bulbosus* (Site 3.4), *Cirsium vulgare* (Site 1.2), *Holcus lanatus* (Site 3.3) and *Cerastium vulgare* (Site 1.4) occur in appreciable numbers or have become established in otherwise undisturbed native vegetation, and only *Senecio jacobaea* (Sites 1.2, 3.3) was listed as a declared weed under Tasmania's *Weed Management Act 1999*.

The most important families in terms of species richness are the Asteraceae, Poaceae, Epacridaceae and Proteaceae. Species of the Restionaceae were the most abundant, especially *Empodisma minus*, whereas the Myrtaceae (*Eucalyptus*) and Epacridaceae (*Leptecophylla*, *Richea*, *Epacris*) dominated the wooded and heathy areas.

Bryophytes

A total of 68 bryophyte taxa from 37 different families were collected: 50 mosses and 18 liverworts (Table 3).

Only one endemic bryophyte was found: *Sphagnum fuscovinosum*, growing at the edge of Kenneth Lagoon (Site 2.2), submerged in a narrow band at the water's edge, amongst *Astelia alpina* tussocks. One moss (*Ulota viridis*) and three liverworts (*Chiloscyphus perpusillus*, *C. subporosus* and *Lepidozia concinna*) are known also from New Zealand, but within Australia, occur only in Tasmania.

In terms of biomass, the most significant bryophyte at Skullbone Plains is *Sphagnum cristatum*, with its large mounds often comprising an entire vegetation type: *Sphagnum* peatland. (Harris and Kitchener 2005). *Sphagnum* hummocks were often found at the edges of *Eucalyptus* woodland (Site 1.4) or in openings in *Leptospermum* scrub (Site 6.2). They also occurred in open areas beside lagoons (Site 2.1, and near Site 2.2). However, the largest area of *Sphagnum* visited for this study covered approximately 5 hectares, at the southern edge of the property (Site 2.1). Bryophyte diversity at this site was very low, but the total biomass is presumably very high, given the

size of the hummocks. In many cases, *Sphagnum* hummocks were overtopped by emergent vascular plants, such as *Richea scoparia* and *Gleichenia alpina*.

Lichens

One hundred and sixty-eight taxa of lichens were recorded (Table 4). This inventory includes many novelties, and as a result of the survey, eight new species were described: *Baculifera metaphragmioides* (Elix and Kantvilas 2014, *Buellia nebulosa*, *B. poimenae* and *B. testaceina* (Elix and Kantvilas 2013, *Caloplaca epibrya* (Kantvilas and Søchting 2013) and *Rimularia albotessellata*, *R. aspicilioides* and *R. circumgrisea* (Kantvilas 2014). A further ten species (*Cyphelium inquinans*, *Ephebe tasmanica*, *Immersaria athroocarpa*, *Lecanora bicincta*, *Lepraria caesioalba*, *Ochrolechia blandior*, *Opegrapha atra*, *Placynthiella oligotropha*, *Porpidia macrocarpa* and *Rhizocarpon reductum* are recorded for Tasmania for the first time. Some of these have been collected previously in the state, but have not been cited previously in the literature. Eleven species are endemic to Tasmania (Table 4). No lichen species that are listed under Tasmania's *Threatened Species Protection Act 1995* were recorded. However, several species are considered interesting records of very uncommon lichens from a Tasmanian perspective, viz. *Cyphelium inquinans* (rare and scattered on the Central Plateau); *Lecanora bicincta* (known from only one other highland locality) and the endemic *Solenopsora tasmanica* (very rare, inconspicuous and widely scattered in highland localities).

DISCUSSION

Vascular plants

The vegetation of the Skullbone Plains property as a whole is consistent with the Lower Plateau surface, as described by Jackson (1972), and with the vegetation of the eastern, drier edge of the Southern Plateau, according to Corbett (1996). In spite of its altitude near the upper limit of *Eucalyptus delegatensis* distribution, this is one of the two main forest species occurring on the property, and the main target of logging in the recent past. There is evidence of poor recovery following burns in many logged areas, and both woody debris and open ground are common where logging has occurred. Heavily grazed marsupial lawn is common in logged areas, suggesting that marsupial grazing is likely to be one of the main factors affecting recovery. The property has been used sporadically for stock grazing since the 19^{th} century.

The main forested areas occur primarily on low ridges, and both frost and waterlogging may play a role in the distribution of trees within the property. For example, waterlogging is known to be a limiting factor in *E. coccifera* colonisation in inverted tree-lines on Mount Wellington (Gilfedder 1988). Similarly *Eucalyptus gunnii* is known to be highly tolerant of both seasonal waterlogging and hard frosts (Pemberton 1986; Corbett 1996) and, within the study area, this species is restricted to forest margins around open ground and frost hollows with poor drainage

Buttongrass moorland is a dominant vegetation type in Tasmania and can be found in a range of habitats, from sea-level

Fig. 3. Buttongrass (*Gymnoschoenus sphaerocephalus*) occurs at Skullbone Plains as small, localised patches.

to alpine elevations, generally associated with high rainfall or poor drainage (Jarman *et al.* 1988). While buttongrass is a common or dominant component of poorly-drained areas to the west of the study site, for example at Navarre Plains or around Lake St Clair, within Skullbone Plains it is restricted to small patches, such as near the Nive River (Site 1.1, **Figs 1** & **3**), or in defined bands around areas of poor drainage where it forms almost monospecific stands.

Conifers were observed only along the riverine corridor of the Nive River and the margins of Lake Ina, both outside the study area and both providing fire refugia. This may reflect the past fire history of Skullbone Plains. The property was being advertised as a prime grazing property in the 1860s (*The Mercury* 1864) and may have been regularly burned to improve the grass cover.

The rate of vascular plant endemism at Skullbone Plains (25.4%) is only slightly lower than that for Tasmania as a whole (27.6%, Baker and de Salas 2013). In contrast, the number of rare or threatened species encountered during the survey was significantly lower than expected. While 24.8% of Tasmania's native plant species are listed in the *Threatened Species Protection Act 1995*, only three listed taxa (1.7% of the flora surveyed), were found at Skullbone Plains. *Uncinia elegans* and *Pherosphaera hookeriana* were collected in the riparian area of the Nive River, in the north-eastern-most corner of the property (Site 1.1), and *Hovea montana* is moderately common in the central area of the reserve, near Sites 1.3 and 1.4. A number of factors may account for the few collections of rare taxa, including the timing of most of the visit (late summer / early autumn), with not many plants flowering at this time (and therefore not being detected), and a history of disturbance through grazing and possibly fire. Small herbaceous taxa such as orchids are particularly inconspicuous at this time.

Fifteen exotic taxa were found during the survey. The most common and widespread is *Cirsium vulgare* (Spear Thistle), found throughout the reserve in previously logged forested habitats and along roadsides. Although widespread and common, it is not abundant, and was only observed at a small number of locations and only ever

in small numbers. The majority of exotic taxa present are fast-growing annuals, able to complete their life-cycle before native plants can become established. They are largely confined to disturbed sites such as along vehicle tracks or in areas cleared for timber loading and harvesting. It is likely that the majority of exotic taxa restricted to disturbed areas are recent introductions through modern logging practices.

Only two species were recorded as invasive at Skullbone Plains: *Holcus lanatus* [recorded in shrubby Restionaceae sedgeland with epacrids, *Baeckea* and *Astelia* mounds (Site 1.3)] and *Cerastium vulgare* [also in Restionaceae sedgeland with scattered heath (Site 1.4)]. Both were growing amongst what appeared to be undisturbed vegetation. These species were limited to small areas of approximately 1 m^2, growing as scattered individuals through the native vegetation and were not observed at any other sites on the reserve. It is possible that both *H. lanatus* and *C. vulgare* are historical introductions to the reserve from its time as a grazing property. In general, exotic vascular plants encountered in the reserve were limited to a small number of plants and were largely unnoticeable, in spite of widespread severe disturbance. This is consistent with Parks *et al.* (2005), who showed that wilderness habitats in alpine zones have a low susceptibility to invasion by exotic species. Although Skullbone Plains is not defined as alpine vegetation it does in some parts approach sub-alpine habitats, it was obvious that the non-disturbed parts of the reserve were largely free of exotic species.

A single, large invasion (10 m × 50 m) of *Juncus bulbosus* was recorded on a seasonally-inundated section of the Lake Ina track (Site 3.4, **Fig. 4**). At this site it was close to 100% cover. A likely vector for the introduction of this species is recreational four-wheel drives used mainly to access the Lake Ina area for trout fishing. Of all the weed species encountered, *Juncus bulbosus* should be considered a priority for control to reduce the risk of it spreading within the reserve into similar wet native habitats.

Bryophytes

Sphagnum peat bogs were among the most significant and distinctive landscapes encountered in the Skullbone Plains property (**Fig. 5**). *Polytrichum commune*, which is commonly found on peat (McCarthy 2013), was abundant in the *Sphagnum* peatland at Site 4.1, forming large mats around seasonally dry pools. Whinam *et al.* (1989) observed that, amongst the other bryophyte species that occur in *Sphagnum* peatlands, *Polytrichum juniperinum* appeared to be the most common. At Skullbone Plains, we found *P. juniperinum* on soil and rock in both wet and dry habitats, but not within the *Sphagnum*. In comparison to vascular plants, endemicity in Tasmanian bryophytes is low; in mosses the figure is approximately 9% (Seppelt *et al.* 2013). Only one Tasmanian endemic was collected during this survey, *Sphagnum fuscovinosum*. However, it should be noted that Karlin *et al.* (2008) have proposed that this species is synonymous with European *S. comosum*, together with *S. simplex* from New Zealand.

The greatest diversity of bryophytes was observed on shaded boulder fields, such as near the Nive River (Site 1.1) and beside the unnamed lagoon near the southern edge of the property (Site 2.1). Fourteen of the 26 taxa (19 mosses and

7 liverworts) seen at these sites were not found elsewhere on the property.

Most bryophytes at Skullbone Plains were found growing on soil or rock. Epiphytic bryophytes were not well-represented, due to lack of suitable habitat. The *Eucalyptus* woodland communities visited were too dry to support epiphytes. Close examination of the stumps remaining in logged areas (Sites 4.2, 6.3) showed some small individuals of bryophytes, including *Chiloscyphus perpusillus* and *Leptotheca gaudichaudii*. The former is known to occur on the bark of trees (Engel 2010), and it is likely that both species have persisted on the bark since before the trees were felled. As expected at this altitude, there were a number of subalpine or alpine species present. For the mosses these included *Andreaea amblyophylla* and *A. mutabilis*, *Brachythecium paradoxum*, *Bartramia robusta* and *B. mossmaniana*, *Conostomum pusillum*, *Dicranoweisia microcarpa*, *Racomitrium pruinosum*, *Sphagnum cristatum* and *S. fuscovinosum*, *Breutelia pendula*, and *Polytrichum commune*. Among the liverworts found, *Chiloscyphus subporosus* and *Herzogobryum teres* are known to prefer alpine or subalpine habitats.

Some bryophytes are able to cope with extremely harsh conditions, such as those occurring in the open plains areas of the property. *Racomitrium pruinosum* was extremely common in the open heathland at Site 3.1, forming large mats on soil and rock. *Bucklandiella* sp. and *Grimmia trichophylla*, both members of the moss family Grimmiaceae, were also found on dolerite rocks at this site. *Andreaea mutabilis* occurred on outcropping dolerite as well as on rock in *Eucalyptus* woodland.

Open areas such as sedgeland and buttongrass moorland provided habitat for *Campylopus* species. *Campylopus introflexus*, a very common plant at Skullbone Plains, occurred on soil at the edge of buttongrass moorland, forming thick cushions around seasonally dry pools, and growing between *Sphagnum* hummocks. In very exposed places, it was almost black in colour, possibly as a response to high light intensity or to periodic inundation by water. *Campylopus bicolor* was only found once, but it too was in an open and sunny position in buttongrass moorland, at the edge of seepages beside outcropping rock. *Campylopus clavatus* occurred on top of exposed rock in low heathland at Site 3.3.

Chiloscyphus semiteres has been described as "one of the most xeric tolerant of Australian leafy hepatics", and is perhaps the most common liverwort in Tasmania (Engel 2010). At Skullbone Plains, it was found growing in dry places under shrubs in regenerating *Eucalyptus coccifera* woodland, in a sheltered crevice of a tree stump, and on peat in a seeping wet area of a *Sphagnum* bog.

Some species appeared to tolerate a range of environmental conditions. *Breutelia affinis* and *Breutelia pendula* were both very common plants at Skullbone Plains, found on rock and soil. *Breutelia affinis* is known to tolerate dry conditions for part of the year (Scott and Stone 1976). It was found growing on the top surface of rocks in sedgeland, and in more shady places. *Breutelia pendula* prefers damper sites (Meagher and Fuhrer 2003) and was found on damp soil in more protected positions. At lower altitudes, these niches usually support the growth of *Ptychomnion aciculare*. However, this species was seen only twice at Skullbone Plains and both plants were quite small.

Fig. 4. Large invasion of *Juncus bulbosus* colonising a disturbed area of the Lake Ina Track. Note the almost 100% cover of this invasive species.

Lichens

With respect to lichens, any collecting expedition or survey of a localised part or vegetation type in Tasmania will almost certainly yield a large number of well known, readily identifiable species, some obvious novelties and a significant number of collections that cannot be fully identified without devoting considerable (and almost invariably unavailable) resources. Skullbone Plains is no exception. Eight species new to science have been described (see 'Results') although only two, *Buellia nebulosa* and *B. testaceina*, are currently known only from Skullbone Plains. The other novelties are more widespread in Tasmania (and elsewhere) and the survey (and subsequent support from ABRS) hastened their formal description. Several of the other currently unidentified taxa are almost certainly also new to science, but the study necessary for their formal description could not be undertaken within available resources. These include the un-named species of *Amandinea*, *Pertusaria* and *Trapelia*. There remain the unidentified taxa in what are generally regarded as "difficult" groups, notably the lecideoid species. In Table 4, affinities or putative relationships are indicated using "aff." or "cf." but realistically, the correct identification of these specimens will not occur until a comprehensive revision of their groups is undertaken.

In general, the lichen inventory can be

Fig. 5. Peat bog in the southernmost area of Skullbone Plains. Note the vascular plant vegetation, including *Richea scoparia* and *Baloskion australe*, growing on a pure substrate of *Sphagnum*.

regarded as very incomplete as it was based on just two intense days of collecting at just two sites. The level of diversity and number of significant finds illustrates the important contribution of this group to plant biodiversity, the extent to which lichens are still relatively poorly known and described, and the importance of lichen-orientated alpha-taxonomy and taxonomists to the description of vegetation.

CONCLUDING REMARKS

Skullbone Plains property contains some unusual vegetation types, especially the large areas of *Sphagnum* peatland with standing-wave patterns. Two newly-described lichens are unique to the property. However, its vascular plant inventory is not markedly different from that of other areas of the Central Plateau at similar altitude. All species that were encountered during the survey are found elsewhere in Tasmania. Only three rare species were encountered, and whether these and the exotic species persist, decrease or expand at Skullbone Plains will depend on the future management of the reserve.

Table 2. Vascular plant taxa of the Skullbone Plains property. Taxa listed under the *Threatened Species Protection Act 1995* are highlighted in **bold** type.

PTERIDOPHYTES

BLECHNACEAE
Blechnum pennamarina (Poir.) Kuhn subsp. *alpina* (R.Br.) T.C.Chambers & P.A.Farrant

DENNSTAEDTIACEAE
Hypolepis rugosula (Labill.) J.Sm.

DRYOPTERIDACEAE
Polystichum proliferum (R.Br.) C.Presl

GLEICHENIACEAE
e *Gleichenia alpina* R.Br.

ISOETACEAE
e *Isoetes gunnii* A.Braun

LINDSAEACEAE
Lindsaea linearis Berggr.

LYCOPODIACEAE
Lycopodium fastigiatum R.Br.

GYMNOSPERMS

PODOCARPACEAE
e ***Pherosphaera hookeriana*** W.Archer bis

MONOCOTYLEDONS

CENTROLEPIDACEAE
e *Centrolepis muscoides* (Hook.f.) Hieron.

CYPERACEAE
Baumea arthrophylla (Nees) Boeckeler
Carex gaudichaudiana Kunth
Carpha alpina R.Br.
Eleocharis acuta R.Br.
Eleocharis gracilis R.Br.
Eleocharis sphacelata R.Br.
Gymnoschoenus sphaerocephalus (R.Br.) Hook.f.
Isolepis crassiuscula Hook.f.
Schoenus tesquorum J.M.Black
Uncinia elegans (Kuk.) Hamlin

IRIDACEAE
Diplarrena moraea Labill.

JUNCACEAE
Juncus sp.
i *Juncus articulatus* L.
Juncus australis Hook.f.
i *Juncus bulbosus* Vahl
Luzula modesta Buchenau
Luzula novae-cambriae Gand.

JUNCAGINACEAE
Triglochin procera R.Br.

LILIACEAE
e *Astelia alpina* R.Br. var. *alpina*
Herpolirion novae-zelandiae Hook.f.
Wurmbea uniflora Turra

ORCHIDACEAE
Caladenia alpina Scop.
Diuris monticola Opiz
Eriochilus cucullatus (Labill.) Rchb.f.

POACEAE
Agrostis parviflora R.Br.
i *Aira praecox* Griseb.
Amphibromus recurvatus Swallen
i *Anthoxanthum odoratum* L.
Deschampsia cespitosa (L.) P.Beauv.
Deyeuxia carinata L.Watson
Deyeuxia innominata D.I.Morris
Deyeuxia monticola Opiz
Deyeuxia quadriseta (Labill.) Benth.
Dichelachne inaequiglumis (Hack. ex Cheeseman) Edgar & Connor
e *Festuca plebeia* R.Br.
Hierochloë redolens (Vahl) Roem. & Schult.
i *Holcus lanatus* L.
Lachnagrostis aemula (R.Br.) Trin.
e *Lachnagrostis lacunarum* (D.I.Morris) S.W.L.Jacobs
Microlaena stipoides (Labill.) R.Br. var. *stipoides*
i *Poa annua* L.
Poa gunnii Vickery

MONOCOTYLEDONS *Cont'd*

Rytidosperma laeve (Vickery) Connor & Edgar
e *Rytidosperma nitens* (D.I.Morris) H.P.Linder

RESTIONACEAE
Baloskion australe (R.Br.) B.G.Briggs & L.A.S.Johnson
Empodisma minus (Hook.f.) L.A.S.Johnson & D.F.Cutler
Eurychorda complanata (R.Br.) B.G.Briggs & L.A.S.Johnson

XYRIDACEAE
e *Xyris muelleri* Malme

DICOTYLEDONS

APIACEAE
Hydrocotyle hirta R.Br. ex A.Rich.
Hydrocotyle sibthorpioides Lam.
Oreomyrrhis eriopoda (DC.) Hook.f.

ASTERACEAE
Argyrotegium mackayi (Buchanan) J.M.Ward & Breitw.
e *Bedfordia linearis* (Labill.) DC. subsp. *linearis*
Brachyscome radicans Steetz
Brachyscome spathulata Gaudich. subsp. *glabra* (DC.) H.M.Stace
Cassinia aculeata (Labill.) R.Br. subsp. *aculeata*
e *Celmisia asteliifolia* Hook.f.
i *Cirsium vulgare* (Savi) Ten.
Coronidium scorpioides (Labill.) Paul G.Wilson
Cotula alpina (Hook.f.) Hook.f.
Craspedia coolaminica J.Everett & Joy Thomps.
e *Craspedia glauca* (Labill.) Spreng.
e *Craspedia macrocephala* Hook.
Craspedia paludicola Craven
e *Erigeron pappocromus* Labill.
Euchiton involucratus (G.Forst.) Holub
i *Hypochaeris radicata* L.
Lagenophora stipitata (Labill.) Druce
i *Leontodon saxatilis* Lam.
Leptinella reptans (Benth.) D.G.Lloyd & C.J.Webb
Leptorhynchos squamatus (Labill.) Less. subsp. *alpinus* Flann
Microseris lanceolata (Walp.) Sch.Bip.
Olearia algida N.A.Wakef.
Olearia erubescens (DC.) Dippel
e *Olearia phlogopappa* (Labill.) DC. subsp. *gunniana* (DC.) Messina
e *Olearia tasmanica* W.M.Curtis
Olearia viscosa (Labill.) Benth.
e *Ozothamnus antennaria* (DC.) Hook.f.
e *Ozothamnus hookeri* Sond.
e *Ozothamnus ericifolius* Hook.f.
Ozothamnus thyrsoideus DC.
Senecio gunnii (Hook.f.) Belcher
i *Senecio jacobaea* L.
Senecio minimus Poir.
e *Senecio pectinatus* DC. var. *pectinatus*
Senecio prenanthoides A.Rich.
i *Taraxacum officinale* F.H.Wigg.
Xerochrysum subundulatum (Sch.Bip.) R.J.Bayer

BORAGINACEAE
Myosotis australis J.Agardh

CAMPANULACEAE
Isotoma fluviatilis (R.Br.) F.Muell. ex Benth. subsp. *australis* McComb
Wahlenbergia ceracea Lothian
e *Wahlenbergia saxicola* (R.Br.) A.DC.

CARYOPHYLLACEAE
i *Cerastium vulgare* Hartm.
Scleranthus biflorus (J.R.Forst. & G.Forst.) Hook.f.
i *Spergularia marina* (L.) Griseb.
Stellaria angustifolia (Bertol.) Kuntze subsp. *angustifolia*

CLUSIACEAE
Hypericum japonicum Thunb.

CUNONIACEAE
Bauera rubioides Andrews

DILLENIACEAE
Hibbertia prostrata Hook.

DROSERACEAE
Drosera arcturi Hook.
Drosera binata Labill.
Drosera gracilis Planch.
Drosera pygmaea DC.

EPACRIDACEAE
Acrothamnus hookeri (Sond.) Quinn
Epacris gunnii Hook.f.

DICOTYLEDONS *Cont'd*

EPACRIDACEAE *Cont'd*
Epacris lanuginosa Labill.
e *Leptecophylla juniperina* (J.R.Forst. & G.Forst.) C.M.Weiller subsp. *parvifolia* (R.Br.) C.M.Weiller
Leucopogon pilifer N.A.Wakef.
Pentachondra pumila (J.R.Forst. & G.Forst.) R.Br.
e *Richea acerosa* A.Cunn.
e *Richea gunnii* Hook.f.
e *Richea scoparia* Hook.f.
e *Richea sprengelioides* R.Br.
Sprengelia incarnata Sm.

ERICACEAE
e *Gaultheria tasmanica* (Hook.f.) D.J. Middleton

EUPHORBIACEAE
Poranthera microphylla Brongn.

FABACEAE
Bossiaea riparia A.Cunn. ex Benth.
Hovea montana (Hook.f.) J.H.Ross
Oxylobium ellipticum (Vent.) R.Br.
Pultenaea fasciculata (Sw.) Parodi
Pultenaea juniperina Schauer
e *Trifolium dubium* Sibth.

GENTIANACEAE
e *Gentianella diemensis* (Griseb.) J.H.Willis subsp. *diemensis*
e *Gentianella eichleri* (L.G.Adams) Glenny

GERANIACEAE
Geranium potentilloides L'Hér. ex DC. var. *potentilloides*

GOODENIACEAE
Velleia montana Hook.f.

HALORAGACEAE
Gonocarpus serpyllifolius Hook.f.
Myriophyllum pedunculatum Klotzsch ex Krauss subsp. *pedunculatum*

LAMIACEAE
i *Prunella vulgaris* L.

LENTIBULARIACEAE
Utricularia dichotoma Labill.
Utricularia monanthos Hook.f.

LINACEAE
Linum marginale A.Cunn.

LOGANIACEAE
Schizacme montana (Hook.f. ex Benth.) Dunlop

MENYANTHACEAE
Liparophyllum gunnii Hook.f.
Ornduffia reniformis (R.Br.) Tippery & Les

MYRTACEAE
Baeckea gunniana Schauer
e *Eucalyptus coccifera* Hook.f.
e *Eucalyptus gunnii* Hook.f.
Leptospermum lanigerum (Sol. ex Aiton) Sm.
Melaleuca virens Craven

ONAGRACEAE
Epilobium billardierianum Ser.
Epilobium curtisiae P.H.Raven
Epilobium gunnianum (Harv.) Kutz.
Epilobium sarmentaceum Hausskn.

OXALIDACEAE
Oxalis exilis A.Cunn.
Oxalis magellanica G.Forst.

PITTOSPORACEAE
Billardiera macrantha Turcz.

PLANTAGINACEAE
e *Plantago glabrata* Hook.f.
e *Plantago gunnii* Hook.f.
e *Plantago paradoxa* Hook.f.
e *Plantago tasmanica* Hook.f. var. *archeri* (Hook.f.) W.M.Curtis

POLYGALACEAE
Comesperma retusum Labill.

PORTULACACEAE
Montia australasica Hook.

PRIMULACEAE
i *Lysimachia arvensis* (L.) U.Manns & Anderb.

PROTEACEAE
Banksia marginata Cav.
e *Bellendena montana* R.Br.
Grevillea australis R.Br.
e *Hakea epiglottis* Labill. subsp. *epiglottis*
Hakea lissosperma R.Br.
Hakea microcarpa R.Br.
e *Lomatia polymorpha* R.Br.
e *Lomatia tinctoria* (Labill.) R.Br.
e *Orites revolutus* R.Br.
e *Persoonia muelleri* (P.Parm.) Orchard subsp. *muelleri*

DICOTYLEDONS *Cont'd*

PROTEACEAE *Cont'd*
e *Telopea truncata* (Labill.) R.Br.

RANUNCULACEAE
e *Ranunculus nanus* Hook.f.
Ranunculus scapiger Hook.

ROSACEAE
e *Acaena montana* Armstr.
Acaena novae-zelandiae Kirk

RUBIACEAE
Asperula gunnii Hook.f.
Coprosma hirtella Labill.
Coprosma moorei F.Muell. ex Rodway
Coprosma nitida Hook.f.
Galium ciliare Hook.f. subsp. *terminale* I.Thomps.

RUTACEAE
Boronia parviflora Michx.

SCROPHULARIACEAE
Gratiola nana L.
Veronica calycina R.Br.
Veronica gracilis Hook.f.

STYLIDIACEAE
Stylidium graminifolium Sw.

TREMANDRACEAE
Tetratheca procumbens (Lehm.) Steud.

VIOLACEAE
Viola betonicifolia Sm. subsp. *betonicifolia*
Viola fuscoviolacea (L.G.Adams) T.A.James

WINTERACEAE
Tasmannia lanceolata Warb.

Table 3. Bryophyte taxa of the Skullbone Plains property. Nomenclature follows Streimann & Klazenga (2002) and Tropicos,org. Missouri Botanical Garden http://www.tropicos.org.org (accessed 29 July 2014).

MOSSES

AMBLYSTEGIACEAE
- *Acrocladium chlamydophyllum* (Hook.f. & Wilson) Müll.Hal. & Broth.

ANDREAEACEAE
- *Andreaea amblyophylla* Müll.Hal. ex Broth.
- *Andreaea mutabilis* Hook.f. & Wilson

BARTRAMIACEAE
- *Bartramia mossmaniana* Müll.Hal.
- *Bartramia robusta* Hook.f. & Wilson
- *Breutelia affinis* (Hook.) Mitt.
- *Breutelia pendula* (Sm.) Mitt.
- *Conostomum pusillum* Hook.f. & Wilson

BRACHYTHECIACEAE
- *Brachythecium paradoxum* (Hook.f. & Wilson) A.Jaeger
- *Brachythecium rutabulum* (Hedw.) Schimp.

BRYACEAE
- *Bryum argenteum* Hedw.
- *Bryum* sp.
- *Rosulabryum billardierei* (Schwägr.) J.R.Spence

CATAGONIACEAE
- *Catagonium nitens* (Brid.) Cardot subsp. *nitens*

DICRANACEAE
- *Campylopus bicolor* (Hornsch. ex Müll.Hal.) Wilson
- *Campylopus clavatus* (R.Br.) Wilson
- *Campylopus introflexus* (Hedw.) Brid.
- *Dicranoloma billardierei* (Brid.) Paris
- *Dicranoloma robustum* (Hook.f. & Wilson) Paris
- *Dicranoweisia microcarpa* (Hook.f. & Wilson) Paris

DITRICHACEAE
- *Ceratodon purpureus* (Hedw.) Brid.
- *Ditrichum difficile* (Duby) M.Fleisch.

FUNARIACEAE
- *Funaria hygrometrica* Hedw.

GRIMMIACEAE
- *Bucklandiella* sp.
- *Grimmia trichophylla* Grev.
- *Racomitrium pruinosum* (Wilson) Müll.Hal.

HEDWIGIACEAE
- *Hedwigia ciliata* (Hedw.) P.Beauv.

HOOKERIACEAE
- *Achrophyllum dentatum* (Hook.f. & Wilson) Vitt & Crosby

HYPNACEAE
- *Hypnum chrysogaster* Müll.Hal.
- *Hypnum cupressiforme* Hedw.

HYPNODENDRACEAE
- *Hypnodendron vitiense* Mitt. subsp. *australe* Touw

HYPOPTERYGIACEAE
- *Hypopterygium didictyon* Müll.Hal.

LEMBOPHYLLACEAE
- *Lembophyllum clandestinum* (Hook.f. & Wilson) Lindb. ex Paris
- *Lembophyllum divulsum* (Hook.f. & Wilson) Lindb.

ORTHOTRICHACEAE
- *Ulota viridis* Venturi
- *Zygodon intermedius* Bruch & Schimp.

PLAGIOTHECIACEAE
- *Plagiothecium lamprostachys* (Hampe) A. Jaeger

POLYTRICHACEAE
- *Polytrichum commune* Hedw.
- *Polytrichum juniperinum* Hedw.

POTTIACEAE
- *Barbula calycina* Schwägr.

PTYCHOMNIACEAE
- *Ptychomnion aciculare* (Brid.) Mitt.

RACOPILACEAE
- *Racopilum cuspidigerum* (Schwägr.) Ångstr. var. *convolutaceum* (Müll.Hal.) Zanten & Dijkstra

RHACOCARPACEAE
- *Rhacocarpus purpurascens* (Brid.) Paris

RHIZOGONIACEAE
- *Leptotheca gaudichaudii* Schwägr.

MOSSES *Cont'd*

SPHAGNACEAE
Sphagnum cristatum Hampe
e *Sphagnum fuscovinosum* Seppelt & H.A.Crum
Sphagnum novo-zelandicum Mitt.

SPLACHNACEAE
Tayloria octoblepharum (Hook.) Mitt.

THUIDIACEAE
Thuidiopsis furfurosa (Hook.f. & Wilson) M. Fleisch.
Thuidiopsis sparsa (Hook.f. & Wilson) Broth.

LIVERWORTS

ANEURACEAE
Riccardia crassa (Schwägr.) Carrington & Pearson
Riccardia sp.

LOPHOCOLEACEAE
Chiloscyphus cf *perpusillus* (Hook.f. & Taylor) J.J.Engel
Chiloscyphus semiteres (Lehm. & Lindenb.) Lehm. & Lindenb.
Chiloscyphus subporosus (Mitt.) J.J.Engel & R.M.Schust.

GEOCALYCACEAE
cf. *Leptoscyphus* sp.

GYMNOMITRIACEAE
Herzogobryum teres (Carrington & Pearson) Grolle

JUNGERMANNIACEAE
Jamesoniella colorata (Lehm.) Spruce ex Schiffn.
Liverwort sp.

LEPICOLEACEAE
Lepicolea scolopendra (Hook.) Dumort. ex Trevis.

LEPIDOZIACEAE
Lepidozia cf. *concinna* Colenso
Lepidozia procera Mitt.
Lepidozia ulothrix (Schwägr.) Lindenb.
Telaranea sp.

MARCHANTIACEAE
Marchantia berteroana Lehm. & Lindenb.

METZGERIACEAE
Metzgeria sp.1
Metzgeria sp.2

PALLAVICINIACEA
Symphyogyna podophylla (Thunb.) Mont. & Nees

Table 4. Alphabetical list of Lichen taxa of the Skullbone Plains property. For clarity, family associations have not been included.

Amandinea sp.
Arthonia didyma Körb.
Aspicilia cf. *cinerea* (L.) Körb.
Austroparmelina pseudorelicina (Jatta) A. Crespo, Divakar & Elix
Baculifera metaphragmioides Elix & Kantvilas
Baeomyces heteromorphus Nyl. ex C. Bab. & Mitten
Buellia dissa (Stirt.) Zahlbr.
e *Buellia nebulosa* Elix & Kantvilas
Buellia poimenae Elix & Kantvilas
Buellia subcrassata (Pusswald) Elix
e *Buellia testaceina* Elix & Kantvilas
Buellia xanthonica (Elix) Elix
Calicium abietinum Pers.
Calicium adspersum Pers. subsp. *australe* Tibell
Calicium salicinum Pers.
Caloplaca epibrya Kantvilas & Søchting
Catillaria contristans (Nyl.) Zahlbr.
Chaenotheca chrysocephala (Ach.) Th. Fr.
Cladia aggregata (Sw.) Nyl.
Cladia fuliginosa Filson
Cladia retipora (Labill.) Nyl.
Cladia schizopora (Nyl.) Nyl.
Cladia sullivanii (Müll. Arg.) W. Martin
Cladonia capitellata (Hook.f. & Taylor) C. Bab. var. *capitellata*
Cladonia chlorophaea (Flörke ex Sommerf.) Spreng.
Cladonia confusa R. Sant.
Cladonia corniculata Ahti & Kashiwadani
Cladonia cryptochlorophaea Asah.
Cladonia pleurota (Flörke) Schaer.
Cladonia pyxidata (L.) Hoffm.
Cladonia ramulosa (With.) J.R. Laundon
Cladonia rigida (Hook.f. & Taylor) Hampe var. *rigida*
Cladonia sarmentosa (Hook.f. & Taylor) C.W. Dodge
Cladonia subsubulata Nyl.
Cladonia tenerrima (Ahti) S. Hammer
Cladonia ustulata (Hook.f. & Taylor) Leighton
Cladonia weymouthii F. Wilson ex A.W. Archer
Collema laeve Hook.f. & Taylor var. *senecionis* (F. Wilson) Degelius
Cyphelium inquinans (Sm.) Trevis.
Diploschistes muscorum (Scop.) R. Sant. subsp. *bartlettii* Lumbsch
Diploschistes scruposus (Schreb.) Norman
Ephebe tasmanica Cromb.
Flavoparmelia haysomii (Dodge) Hale
Fuscidea australis Kantvilas var. *australis*
Fuscopannaria decipiens P.M. Jørg.
Haematomma nothofagi Kalb & Staiger
Hertelidea aspera (Müll. Arg.) Kantvilas & Elix
Hymenelia gyalectoidea Kantvilas
Hymenelia sp.
Hypocenomyce australis Timdal
Hypocenomyce foveata Timdal
Hypogymnia enteromorphoides Elix
Hypogymnia kosciuskoensis Elix
Hypogymnia lugubris (Pers.) Krog
Hypogymnia mundata (Nyl.) Oxner ex Rass.
Hypogymnia tasmanica Elix
Immersaria athroocarpa (Ach.) Rambold & Pietschmann
Japewiella pruinosula (Müll. Arg.) Kantvilas
Lecanora bicincta Ramond
Lecanora caesiorubella Ach.
Lecanora cf. *demersa* (Kremp.) Hertel & Rambold
Lecanora epibryon (Ach.) Ach. subsp. *xanthophora* Lumbsch
Lecanora farinacea Fée
Lecanora lugubris (C.W. Dodge) D.J. Galloway
Lecanora polytropa (Hoffm.) Rabenh.
Lecanora swartzii (Ach.) Ach.
Lecidea atromorio C. Knight
Lecidea cf. *fuscoatrula* Nyl.
Lecidea cf. *lapicida* (Ach.) Ach.
Lecidea sp. A
Lecidea sp. B
Lecidella sublapicida (Knight) Hertel
Lecidella xylogena (Müll. Arg.) Kantvilas & Elix
Lepraria caesioalba (de Lesd.) J.R. Laundon
Lepraria yunnaniana (Hue) Zahlbr.
Leptogium sp.
Megalaria grossa (Pers. ex Nyl.) Hafellner
Megalaria laureri (Hepp ex Th.Fr.) Hafellner
Menegazzia globulifera R. Sant.
Menegazzia pertransita (Stirt.) R. Sant.
Menegazzia platytrema (Müll. Arg.) R. Sant.
e *Menegazzia ramulicola* Kantvilas
e *Menegazzia subtestacea* Kantvilas
e *Meridianelia maccarthyana* Kantvilas & Lumbsch
Micarea cinerea (Schaerer) Hedl.

Micarea cf. *elachista* (Körber) Coppins & R.Sant.
Mycobilimbia australis Kantvilas & Messuti
Mycoblastus campbellianus (Nyl.) Zahlbr.
Mycoblastus coniophorus (Elix & A.W. Archer) Kantvilas & Elix
Nephroma cellulosum (Sm. ex Ach.) Ach.
Ochrolechia androgyna (Hoffm.) Arnold
Ochrolechia blandior (Nyl.) Darb.
Ochrolechia xanthostoma (Sommerf.) K. Schmitz & Lumbsch
Opegrapha atra Pers.
Pannaria sp.
Pannoparmelia angustata (Pers.) Zahlbr.
Paraporpidia leptocarpa (C. Bab. & Mitt.) Rambold & Hertel
Parasiphula georginae (Kantvilas) Kantvilas & Grube
Parmelia cunninghamii Crombie
Parmelia signifera Nyl.
Parmeliella nigrocincta (Mont.) Müll. Arg.
Parmeliella thysanota (Stirt.) Zahlbr.
Parmeliella sp.
Peltigera polydactylon (Neck.) Hoffm.
Pertusaria lophocarpa Körber
Pertusaria novaezelandiae Szatala
Pertusaria sp.
Placopsis aff. *bicolor* (Tuck.) B. de Lesd.
Placopsis gelida (L.) Lindsay
Placynthiella oligotropha (J.R. Laundon) Coppins & P. James
Porpidia macrocarpa (DC.) Hertel & A.J. Schwab
Porpidia cf. *umbonifera* (Müll. Arg.) Rambold
Porpidia sp.
Protoparmelia badia (Hoffm.) Hafellner
Pseudocyphellaria crocata (L.) Vain.
Pseudocyphellaria glabra (Hook.f. & Taylor) C.W. Dodge
Psilolechia lucida (Ach.) M. Choisy
Psoroma caliginosum Stirton
Psoroma hypnorum (Vahl) S.F. Gray
Psoroma paleaceum (Fr.) Nyl.
Ramalina unilateralis F. Wilson
Ramboldia laeta (Stirt.) Kalb, Lumbsch & Elix
Ramboldia petraeoides (Nyl. ex C. Bab. & Mitt.) Kantvilas & Elix
Ramboldia plicatula (Müll. Arg.) Kantvilas & Elix
Ramboldia stuartii (Hampe) Kantvilas & Elix
Rhizocarpon geographicum (L.) DC.
Rhizocarpon reductum Th. Fr.
Rhizocarpon sp.
e *Rimularia albotessellata* Kantvilas
e *Rimularia aspicilioides* Kantvilas
e *Rimularia circumgrisea* Kantvilas
Rimularia psephota (Tuck.) Hertel & Rambold
Siphula decumbens Nyl.
Siphula fastigiata (Nyl.) Nyl.
Siphulastrum mamillatum (Hook.f. & Taylor) D.J. Galloway
e *Solenopsora tasmanica* Kantvilas
Stereocaulon caespitosum Redinger
Stereocaulon corticatulum Nyl.
Stereocaulon ramulosum (Sw.) Räusch.
Tasmidella variabilis Kantvilas, Hafellner & Elix var. *variabilis*
Tephromela atra (Huds.) Hafellner
Tephromela sorediata Kalb & Elix
Tephromela sp.
Trachylia emergens F. Wilson
Trapelia lilacea Kantvilas & Elix
Trapelia sp.
Trapeliopsis flexuosa (Fr.) Coppins & P. James
Trapeliopsis granulosa (Hoffm.) H.T. Lumbsch
Umbilicaria cylindrica (L.) Delise ex Duby
Umbilicaria umbilicarioides (B. Stein) Krog & Swinscow
Usnea inermis Motyka
Usnea molliuscula Stirt.
Usnea oncodes Stirt.
Usnea torulosa (Müll. Arg.) Zahlbr.
Usnea xanthopoga Nyl.
e *Verrucaria tasmanica* P.M. McCarthy
Xanthoparmelia elixii Filson
Xanthoparmelia loxodella (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch
Xanthoparmelia metaclystoides (Kurok. & Filson) Elix & J. Johnst.
Xanthoparmelia mougeotina (Nyl.) D.J. Galloway
Xanthoparmelia neotinctina (Elix) Elix & J. Johnst.
Xanthoparmelia phillipsiana (Filson) Elix & J. Johnst.
Xanthoparmelia scabrosa (Taylor) Hale
Xanthoparmelia stygiodes (Nyl. ex Cromb.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch
Xanthoparmelia subprolixa (Nyl. ex Kremp.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch
Xanthoparmelia taractica (Kremp.) Hale
Xanthoparmelia tegeta Elix & J. Johnst.
Xanthopsoroma contextum (Stirt.) Elvebakk

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